FREMONT BASIN

INTEGRATED REGIONAL WATER MANAGEMENT PLAN

FEBRUARY 2019

IRWMP

Prepared by the Regional Water Management Group of the
Fremont Basin Integrated Regional Water Management Region

Fremont Basin

Integrated Regional Water Management Plan

February 2019

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With assistance from Woodard & Curran

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Acronym/Abbreviation	Definition
°F	degrees Fahrenheit
µg/L	Micrograms per Liter
µS/cm	Microsiemens per Centimeter
AB	Assembly Bill
ACS	American Community Survey
AF	Acre-Feet
AF/acre	Acre Feet per Acre
AFY	Acre-Feet per Year
AVEK	Antelope Valley-East Kern Water Agency
BLM	United States Bureau of Land Management
BMP	Best Management Practices
CA	California
Cal Water	California Water Service Company
CalEPA	California Environmental Protection Agency
California City	City of California City
CARB	California Air Resources Board
CASGEM	California Statewide Groundwater Elevation Monitoring
CDFW	California Department of Fish and Wildlife
Chromium-6	Hexavalent Chromium
CIMIS	California Irrigation Management System
CIP	Capital Improvement Program
City	City of California City
County	Kern County
CWA	Clean Water Act
CWC	California Water Code
CWSRF	Clean Water State Revolving Fund
DAC	Disadvantaged Community
DACI Program	Disadvantaged Community Involvement Program
Delta	Sacramento-San Joaquin Delta

DMS	Data Management System
DOF	California Department of Finance
DPR	Direct Potable Reuse
DRECP	Desert Renewable Energy Conservation Plan
DWR	California Department of Water Resources
DWSRF	Drinking Water State Revolving Fund
EDA	Economically Distressed Areas
EHS	Kern County Public Health Services Department
EIR	Environmental Impact Report
ETc	Crop Evapotranspiration
ETo	Evapotranspiration
FEMA	Federal Emergency Management Agency
FVGB	Fremont Valley Groundwater Basin
GAMA	Groundwater Ambient Monitoring and Assessment Program
GAP	Gap Analysis Project
GHG	Greenhouse Gas Emissions
GIS	Geographic Information Systems
GPCD	Gallons per Capita per Day
GSA	Groundwater Sustainability Agency
GSP	Groundwater Sustainability Plan
GWMP	Groundwater Management Plan
in.	Inches
IPCC	Intergovernmental Panel on Climate Change
IPR	Indirect Potable Reuse
IRWM	Integrated Regional Water Management
Kc	Crop Coefficient
LADWP	Los Angeles Department of Water and Power
LID	Low Impact Development
LRWQCB	Lahontan Regional Water Quality Control Board
MAF	Million Acre-Feet
MCL	Maximum Contaminant Limit
MG	Million Gallons

mg/L	Milligrams per Liter
MGD	Million Gallons per Day
MHI	Median Household Income
MOU	Memorandum of Understanding
MPUD	Mojave Public Utilities District
msl	Mean Sea Level
MW	Megawatts
N.D.	No Date
NAHC	California Native American Heritage Commission
NO3	Nitrate Oxide
O&M	Operations and Maintenance
PHG	Public Health Goal
ppb	Parts per Billion
QA/QC	Quality Assurance/Quality Control
RAP	Region Acceptance Process
RAS	Return Activated Sludge
RCP	Representative Concentration Pathway
RCWD	Rand Communities Water District
Region	Fremont Basin Integrated Regional Water Management Region
RMS	Resource Management Strategy
RWMG	Regional Water Management Group
SB	Senate Bill
SDAC	Severely Disadvantaged Community
SDWIS	Safe Drinking Water Information System
SGMA	Sustainable Groundwater Management Act
SNMP	Salt and Nutrient Management Plan
State Park	Red Rock Canyon State Park
SWP	State Water Project
SWRCB	State Water Resources Control Board
SWRP	Stormwater Resource Plan
TCCWD	Tehachapi-Cummings County Water District
TDS	Total Dissolved Solids

TMDL	Total Maximum Daily Load
US	United States
USACE	United States Army Corps of Engineers
USBR	United States Department of the Interior Bureau of Reclamation
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
UWMP	Urban Water Management Plan
WAS	Waste Activated Sludge
WDL	Water Data Library
WEP	Water and Environmental Program
WIFIA	Water Infrastructure Finance and Innovation Act
Work Plan	Lahontan Funding Area DACI Work Plan
WSD	Water Storage District
WWTP	Wastewater Treatment Plant

1 Governance and Planning

1.1 Introduction

Integrated regional water management (IRWM) planning is a collaborative effort to manage all aspects of water resources in a region defined by either natural or artificial boundaries. IRWM crosses jurisdictional, water, and political boundaries; involves multiple agencies, stakeholders, individuals, and groups; and it attempts to address the issues and differing perspectives of all entities involved through mutually beneficial solutions. The IRWM process involves identifying and implementing water management solutions on a regional scale to increase regional self-reliance, reduce conflict, and manage water in a way that concurrently achieves social, environmental, and economic objectives.

1.1.1 Integrated Regional Water Management Overview

In 2002, the California legislature passed the Integrated Regional Water Management Planning Act (Senate Bill (SB) 1672) to encourage local agencies to work cooperatively to manage local and imported water supplies, and to improve water quality, quantity, and reliability. The IRWM Planning Act provided an avenue for self-identified regions to develop IRWM Plans and ultimately apply for grant funding to support IRWM Programs through related bond measures. The California Department of Water Resources (DWR) is the State agency that manages the IRWM Program through grant programs and technical and facilitation services. Since the creation of the IRWM Planning Act in 2002, California voters have passed various bond acts that have provided over $1.5 billion in State funding to support and advance integrated, multi-benefit and regional projects. These bond acts include:

- Proposition 50 (2002), the *Water Security, Clean Drinking Water, Coastal and Beach Protection Act*, which provided $510 million to fund competitive grants for projects consistent with an adopted IRWM Plan
- Proposition 1E (2006), the *Disaster Preparedness and Flood Prevention Bond Act*, which provided $300 million for IRWM Stormwater and Flood Management
- Proposition 84 (2006), the *Safe Drinking Water, Water Quality, and Supply, Flood Control, River and Coastal Protection Bond Act*, which provided $1 billion for IRWM planning and implementation
- Proposition 1 (2014), the *Water Quality, Supply, and Infrastructure Improvement Act*, which provided $510 million for IRWM planning and implementation

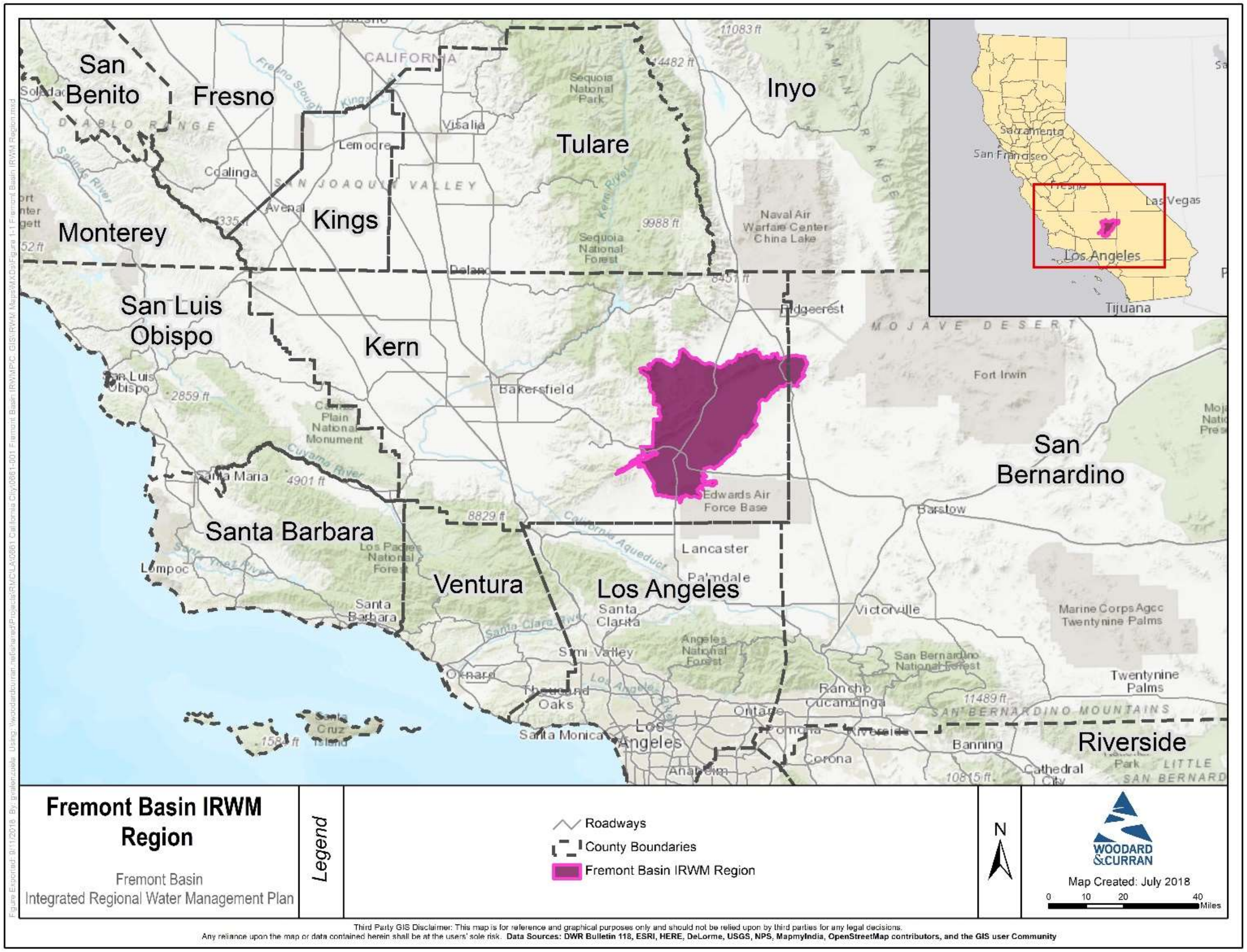
An integral part of the IRWM Program is developing an IRWM Plan (IRWMP or Plan). An IRWMP is a comprehensive document that is the outcome of IRWM planning efforts. The Plan reflects efforts and objectives of all stakeholders within a defined region and documents the development and implementation of effective strategies that promote sustainable water use, guarantee a reliable water supply, improve water quality, and endorse environmental stewardship within the region. IRWMPs also describe the water supply portfolio and demands in the region, as well as highlight the existing and projected water management challenges with respect to climate change impacts and population changes.

1.1.2 Fremont Basin IRWM Region

The Fremont Basin IRWM Region (Region) was approved by the DWR in September 2011 through the IRWM Region Acceptance Process (RAP). The Region boundaries were later updated in 2018 to incorporate the entirety of the underlying Fremont Valley Groundwater Basin (FVGB). The Region encompasses 992 square miles in eastern Kern County and western San Bernardino County in the western edge of the Mojave Desert, as shown in **Figure 1-1** . The only incorporated city in the Region is the City of California City (City), which is home to approximately 14,200 residents, most of whom reside within the FVGB (California City Water Department 2017). The primary defining water resources of the Fremont Basin IRWM Region is the FVGB. Additional information about the Region is described in *Chapter 2: Region Description*.

The Fremont Basin IRWM Region, located in the western edge of the Mojave Desert

Figure 1-1: Fremont Basin IRWM Region



1.2 Governance

1.2.1 Regional Water Management Group

Regional Water Management Groups (RWMGs) are formed to facilitate coordination, collaboration, and communication between all stakeholders in an IRWM Region. RWMGs must be composed of at least three local agencies, with at least two having statutory authority over water supplies. On October 21, 2014, the City of California City (California City or City), the Mojave Public Utilities District (MPUD), and the Antelope Valley-East Kern Water Agency (AVEK) signed a memorandum of understanding (MOU) forming the Fremont Basin RWMG. The MOU, included in the Plan as Appendix A, defines the organization, responsibilities, and governance structure for the Fremont Basin RWMG. The RWMG agreed to fund the development of the first Fremont Basin IRWMP, provide and share information for the Plan development, review drafts, adopt the final Plan, and assist with future IRWM grant applications (City of California City, AVEK, and MPUD 2014). Each of the RWMG members and their water management role in the Region are described below and are summarized in **Table 1-1**.

City of California City

The City of California City is the lead agency tasked with providing meeting organization and startup funding for the IRWMP. The City is a retail water supplier located in southeastern Kern County, serving over 14,000 residents. The City purchased all water rights to water in, on, and underlying the City in 1960 following an agreement between Boron Valley Water Development Company and Boron Valley Community Service District (later known as the California City Service District). The City is now the only water supplier in the municipality and has a service area encompassing 203 square miles. The City uses six primary groundwater wells to meet water demands and intends to add two more wells in 2019. California City supplements its groundwater supplies with imported water purchased from AVEK (California City Water Department 2017). California City is also responsible for sewer services, land-use planning, flood management, and parks and recreation services within its service area.

Mojave Public Utilities District

MPUD serves 19 square miles of unincorporated residential, commercial, industrial, and undeveloped land in the southeastern portion of Kern County at the western edge of the Mojave Desert. The agency's headquarters is located in the unincorporated community of Mojave, California, near State Highways 14 and 58. MPUD was chartered in 1938 and at that time it was responsible for operating the Southern Pacific Railroad Water Distribution System that had been in operation since the late 1800's. MPUD purchased the local water distribution system from Southern Pacific Railroad in 1940 and expanded distribution facilities in 1958 with the purchase of additional pipelines, reserves, wells, and water rights (MPUD 2004). MPUD distributes water pumped from groundwater wells located northeast, southwest, and northwest of the town of Mojave, as well as imported water purchased from AVEK. MPUD is also responsible for the sewer services within its service area.

Antelope Valley-East Kern Water Agency

AVEK is a wholesale supplier of imported water from the State Water Project (SWP), with a service area covering approximately 2,400 square miles in northern Los Angeles and eastern Kern Counties, as well as a small portion of Ventura County. The agency was granted a charter by the State Legislature in 1959 and signed a water supply contract with DWR for the delivery of imported water supplies from the SWP in 1962. With a Table A Allocation of 144,844 AFY, AVEK has the third largest water allocation of the 29 SWP contractors, following the Metropolitan Water District of Southern California and Kern County Water Agency.

In addition to delivering imported water from the SWP, AVEK uses water from wells located within the Antelope Valley Groundwater Basin outside the Fremont Basin IRWM Region, and occupies one position on the court-appointed Watermaster Board for the Antelope Valley. As the wholesale water supplier in the Fremont Basin IRWM Region, AVEK has implemented several water exchange programs and intends to develop additional long-term exchange and storage programs to increase regional supply reliability.

To augment water supply reliability in its service area, AVEK also manages various groundwater banking programs. AVEK developed the Westside Water Bank Project in 2010 and the Eastside Water Banking and Blending Project in 2016 to store excess SWP water during wet periods. The stored water is extracted and used to supplement water supply during dry periods when water demand is high or when SWP deliveries are insufficient (AVEK 2016).

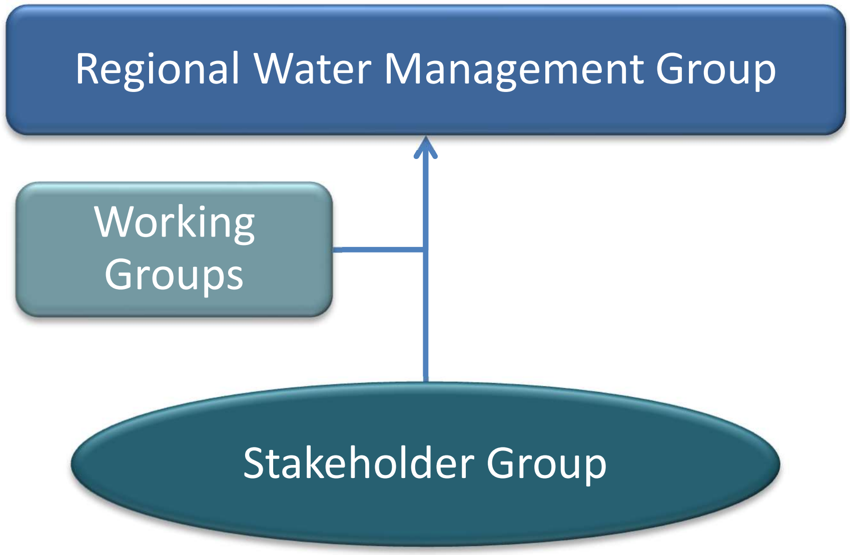
Table 1-1: RWMG Responsibilities in the Fremont Basin IRWM Region

RWMG Agency	Roles and Responsibilities
City of California City	Provides potable water, recycled water, sewer, land-use planning, environmental, flood management, and parks and recreation services within the City of California City
MPUD	Provides potable water and sewer services within its service area in portions of unincorporated Kern County in the south west edge of the Region
AVEK	Imported water wholesaler for the Region and manages groundwater banking programs

1.2.2 Governance Structure and Decision-Making

The RWMG acts as the oversight body for the Fremont Basin IRWM Region. The RWMG makes decisions about Plan development and implementation based on the recommendations and information received from the Fremont Basin IRWM stakeholder group and focused working groups that provide input on key topics. The governance structure for the Fremont Basin IRWM Region is depicted graphically in **Figure 1-2**.

Figure 1-2: Fremont Basin IRWM Region Governance Structure



The role of the RWMG is to provide leadership and guidance for IRWM planning and implementation in the Region. The RWMG directs program activities, reviews projects submitted for inclusion in the Plan, and submits grant applications to the State on behalf of the Region. The RWMG also performs strategic and financial decision-making, and conducts program advocacy to optimize water resources protection in the Region.

The role of the stakeholder group is to provide collaborative input to support IRWM outreach efforts, Plan development, and Plan implementation. Members of the stakeholder group are asked to attend Stakeholder Meetings, and represent the interests and concerns of their respective agency, organization, or interest group. They are a key component of the decision-making process as they provide critical information and support recommendations for the Region.

Stakeholder Meeting #10 held on January 18, 2018 at the City Hall Chambers in California City, CA

Working groups are groups of stakeholders that have volunteered to participate in specialized meetings that focus on particular topics, and advise the RWMG on the development and implementation of the Plan and its supporting documents. Those stakeholders with targeted expertise or interests were invited to join working groups (following Stakeholder Meetings) to provide additional input and information on key topics important to the Region during preparation of this IRWMP. The RWMG announces the opportunities to join working groups at the Stakeholder Meetings and welcomes any interested stakeholder, including representatives of disadvantaged communities (DACs) and tribes, to contact the RWMG about how they can participate further. Input and recommendations from the working groups inform the recommendations of the stakeholder group during decision-making activities. Working groups meet on an as needed basis.

To perform its role and ensure long-term implementation of the Plan, the RWMG typically meets quarterly, and holds public meetings to discuss policy and project selection with Fremont Basin IRWM stakeholders, including DACs and tribal communities as needed. The RWMG seeks to achieve consensus from the stakeholder group on IRWM Program objectives and other key topics at Stakeholder Meetings. Decisions within the RWMG are made based on input and recommendations from the working groups, stakeholder group, DACs, and tribes using broad facilitated agreement, led by the RWMG.

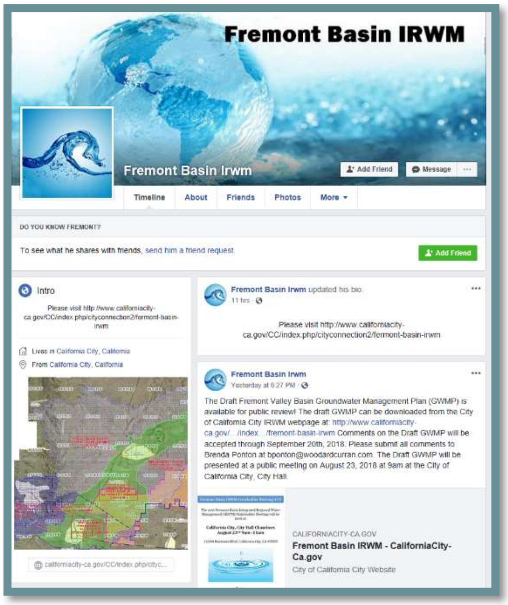
1.3 Stakeholder Involvement

Stakeholders are an important part of the IRWM development process. Stakeholder involvement ensures the Plan is developed to incorporate the interests of a variety of stakeholders, including non-profit groups, public agencies, organizations, and individuals. Stakeholder participation is necessary to identify and address the objectives and resource management strategies of the IRWM Plan. Stakeholders are not required to provide financial contributions to be engaged in the regional planning effort. Instead, they are encouraged to participate in the IRWMP development through providing information and participation at meetings and in working groups.

1.3.1 Stakeholder Involvement and Public Outreach

The Fremont Basin IRWM Program encourages stakeholder involvement in both the development of the IRWM Plan and the continued implementation of the Plan objectives. When the Region was formed, the RWMG developed a potential stakeholder list to aid in publicizing the IRWM Program and soliciting groups that may want to participate in the Plan development. An email list was developed based on groups that had shown interest in the program. Emails providing IRWM background information and process updates were developed and distributed to the potential stakeholders to initiate participation and announce upcoming meetings. A website was developed for the Fremont Basin IRWM Region to inform the public of upcoming Stakeholder Meetings and other IRWM related-efforts. Through the email list and website, the RWMG solicits participation from interested stakeholders and keeps the public informed.

The Fremont Basin IRWM webpage on the City of California City's website



The Fremont Basin IRWM Facebook Page

Two websites provide an avenue for stakeholders to find information about the Fremont Basin IRWM Program: the Fremont Basin IRWM Region Facebook page (https://www.facebook.com/FremontBasinIRWM/) and the Fremont Basin IRWM webpage on the City of California City's website (http://www.californiacity-ca.gov/CC/index.php/fremont-basin-irwm). The Fremont Basin IRWM Region Facebook page helps facilitate stakeholder coordination and promote two-way communication between the RWMG and the stakeholders by allowing group members to post comments and information to the site. The Region's Facebook page, managed by the City of California City, also provides an avenue for the public to send messages to the RWMG through the Facebook messaging function. The RWMG uses both the Facebook page and the Fremont Basin IRWM webpage on California City's website to alert the public about future Stakeholder Meetings and events, and post documents related to the IRWM Program, including meeting agendas, presentations, minutes, and the Plan itself.

The process the RWMG currently uses to identify and involve new stakeholders includes posting public announcements about the IRWM Stakeholder Meetings on the Fremont Basin IRWM webpages; soliciting recommendations for new groups to contact during Stakeholder Meetings; and targeting specific groups via email, phone calls, and letters. Stakeholders are welcome to join the stakeholder group and attend Stakeholder Meetings at any time. Anyone interested in being notified of upcoming meetings, or who wants to send information to the RWMG is welcome to contact the outreach coordinator for the program:

City of California City
21000 Hacienda Blvd.
California City, CA 93505
Phone: (760)373-7153
Fax: (760)373-7532
schavez@californiacity-ca.gov

The Fremont Basin IRWM stakeholders that have been identified and contacted through stakeholder outreach efforts represent a range of interests specific to the Region. The Fremont Basin IRWM stakeholders are listed in **Table 1-2**, and new stakeholders are identified on a continuous basis.

Table 1-2: Fremont Basin IRWM Stakeholders

Entity Type	Agencies and Organizations	
Wholesale, Retail Water Agencies, and Local Water Purveyors	• AVEK • Mojave Public Utilities District • California City • A.F.P. Mutual Water Company • Rancho Seco Inc. • Rand Communities Water District • California Water Service Company • Pinon Hill Water Company • Tehachapi-Cummings County Water District	• Quail Valley Water District-Eastside System • Quail Valley Water District-Westside System • Rosamond Community Services District • William Fisher Memorial Water Company • Kern County Water Agency
Wastewater Agencies	• Mojave Public Utilities District • City of California City	• Kern County Environmental Health Department
Flood Control Agencies	• City of California City	• Kern County Planning and Natural Resources Department
Municipal and County Governments and Special Districts	• City of California City • Community of Cantil • Kern County Planning and Natural Resources Department • Kern County Department of Agriculture and Measurement Standards	• Kern County Development Services Agency • Kern County Supervisor's Office • Surveying & Permit Services Dept. of Engineering • Mojave Chamber of Commerce
Environmental Organizations	• Desert Tortoise Preserve Committee • Friends of Jawbone Canyon	• Eastern Kern County Resource Conservation District • Red Rock Canyon State Park
Community Organizations	• Willow Springs Mobile Home Park	• Red Rock Canyon State Park
Energy Industry	• Beacon Solar NextEra Energy Resources LLC • GE Wind Energy • 8minutenergy	• Strata Equity Group • Next Era Energy • Los Angeles Department of Water and Power
Industry Organizations	• Honda Proving Center of California • Hyundai-Kia Motors • Kern County Farm Bureau • Golden Queen Mining	• California Portland Cement • Mojave Air and Space Port • Rio Tinto
Business	• Arciero & Son	• McMurtrey, Hartsock & Worth
Economic Development	• California City Economic Development Corporation • Kern Economic Development Corporation	• East Kern Economic Alliance
Self-Supplied Water Users / Land Owners	• Varied	

Entity Type	Agencies and Organizations	
State Agencies	• CA Department of Fish and Wildlife • Department of Water Resources • State Water Resources Control Board	• Lahontan Regional Water Quality Control Board • State Senate and Assembly Members
Federal Agencies	• Bureau of Land Management • U.S. Bureau of Reclamation • U.S. Environmental Protection Agency	• U.S. Army Corps of Engineers • U.S. Fish and Wildlife Service
Media	• Mojave Desert News	• Antelope Valley Press
School Districts	• Mojave United School District	
DAC Representatives	• Rancho Seco Inc. • Rand Communities Water District	• Eastern Kern County Resource Conservation District • Mojave Chamber of Commerce
Native American Tribes	• Tubatulabal Indian Tribe	• Tejon Indian Tribe

1.3.2 Disadvantaged Community Outreach

To ensure DAC issues and needs are equally represented in the IRWM Plan, the RWMG conducted targeted DAC outreach to identify, invite and involve groups that could represent DAC interests and needs. Using an initial list of potential DAC representatives developed by the RWMG and building on that list using input and recommendations from stakeholder meetings, the RWMG attempted to notify these groups of the Fremont Basin IRWM Program via email and phone calls.

Several working group meetings focused on ongoing DAC and public outreach efforts. These working groups included members of the RWMG as well as additional stakeholders who showed an interest in participating during Stakeholder Meetings. The goal of the DAC Outreach focused working groups was to encourage participation by DACs, solicit input for updates, and educate target audiences about the purpose and benefits of the IRWM Program.

The Rand Community Building in Johannesburg – one of the several Stakeholder Meeting locations

To facilitate participation of DACs in the IRWM Program, the Fremont Basin IRWM Region has made multiple efforts to reduce potential barriers to DAC involvement. For example, the RWMG holds Stakeholder Meetings in different locations throughout the IRWM Region, including more isolated areas where representatives of DACs will have better access to attend meetings. Because not all stakeholders have the same access to online sources and email, the Fremont Basin IRWM Stakeholder Meeting announcements are communicated through multiple media, including newspaper announcements, the City website, the Fremont Basin IRWM Facebook page, email notifications, and phone calls to specific groups, when appropriate. The RWMG also made hard copies of the public draft IRWM Plan available at a variety of locations in the Region so that DACs had access to the document without needing access to a computer.

DACs are welcome to participate in the program at any time by attending meetings or by contacting a RWMG member. Specifically, DACs can contact the City of California City, the lead RWMG agency, at any time to request information, provide data, voice issues, discuss goals, submit projects, and contribute other information they want considered for inclusion in the Plan. The contact information for the DAC coordination representative is below:

DAC Coordinator
City of California City
21000 Hacienda Blvd.
California City, CA 93505
Phone: (760)373-7153
Fax: (760)373-7532
schavez@californiacity-ca.gov

DAC Involvement Program

In 2016, DWR's Proposition 1 allocated $2.45 million dollars to the Lahontan Funding Area for the DAC Involvement Program (DACI Program). Though the DACI Program is distinct from the Proposition 1 IRWM Planning Grant Program, extensive coordination has occurred between the two programs. The three main goals of the DACI Program are to: 1) encourage IRWM regions to work collaboratively to involve DACs and Economically Distressed Areas (EDAs) in IRWM planning efforts; 2) identify water management-related needs of DACs/EDAs; and 3) develop strategies and long-term solutions that address the identified needs. The DACI Program provides a unique opportunity for the Fremont Basin IRWM Region to explore these barriers and DAC needs.

Throughout 2016 and 2017, the Fremont Basin IRWM Region convened with the Tahoe-Sierra, Inyo-Mono, Mojave, and Lahontan Basins IRWM Regions to develop the Lahontan Funding Area DACI Work Plan (Work Plan). The Work Plan promotes additional DAC outreach to communities new to the IRWM Program and strengthens existing relationships. The Work Plan also sets guidelines to aid in project identification and development to advance projects to the implementation stage. The Work Plan was approved by DWR in May 2017 (DACI 2017). Coordination with the other Lahontan Funding Area Regions and DWR is ongoing as the Work Plan is implemented.

1.3.3 Native American Tribal Outreach

Involving Native American Tribes in the IRWM planning and implementation process helps ensure tribal interests are equally represented in the IRWM development process and that IRWMP objectives are properly identified. Though there are no federally recognized tribes or reservations in the Fremont IRWM Region, there is a Native American land parcel that is currently held in Trust by the U.S. government. Both the Bureau of Indian Affairs and the California Native American Heritage Commission (NAHC) were directly contacted via phone and email and were asked to identify the Native American individual or community who owns the land; they were also asked to determine if there are more tribal interests in the Region. However, communication with tribal representatives determined that there are no recognized tribes or nations in the Region. As such, there are no tribal interests or water issues specific to Native American Tribal Communities identified through this outreach process. Tribal organizations will be contacted during future Plan updates to notify groups of Stakeholder Meetings in case representatives would like to participate in the future.

1.4 Regional Coordination

1.4.1 Coordination with Neighboring IRWM Regions

The Fremont Basin IRWM Region is bordered by four other IRWM Regions: the Inyo-Mono IRWM Region to the north, the Antelope Valley IRWM Region to the south, the Mojave IRWM Region to the east, and the Kern County IRWM Region to the west. The Inyo-Mono, Antelope Valley, and Mojave IRWM Regions share the Lahontan Funding Area with the Fremont Basin IRWM Region, in addition to two other IRWM Regions, Lahontan Basins and Tahoe Sierra. The Kern County IRWM Region is not in the same Funding Area, but it is adjacent to the Region and shares some of the same water resources challenges. While each of these regions share some similarities, they also have distinct water management issues and priorities. The boundary distinction for the Fremont Basin IRWM Region boundary is discussed in *Chapter 2: Region Description*. A map of the neighboring IRWM Regions is provided in **Figure 1-3**.

The Fremont Basin IRWM RWMG coordinated with neighboring IRWM regions prior to and during the development of the 2019 Fremont Basin IRWM Plan. As discussed in *Section 1.3.2: Disadvantaged Community Outreach*, the Region was part of the DACI Program for the Lahontan Funding Area and Work Plan development that involved coordination with other Regions in the Funding Area. Additionally, the Fremont Basin IRWM Boundary was modified during the development of the Plan, which involved coordination with neighboring Regions impacted by the boundary change. These correspondences are discussed further below.

Inyo-Mono IRWM Region

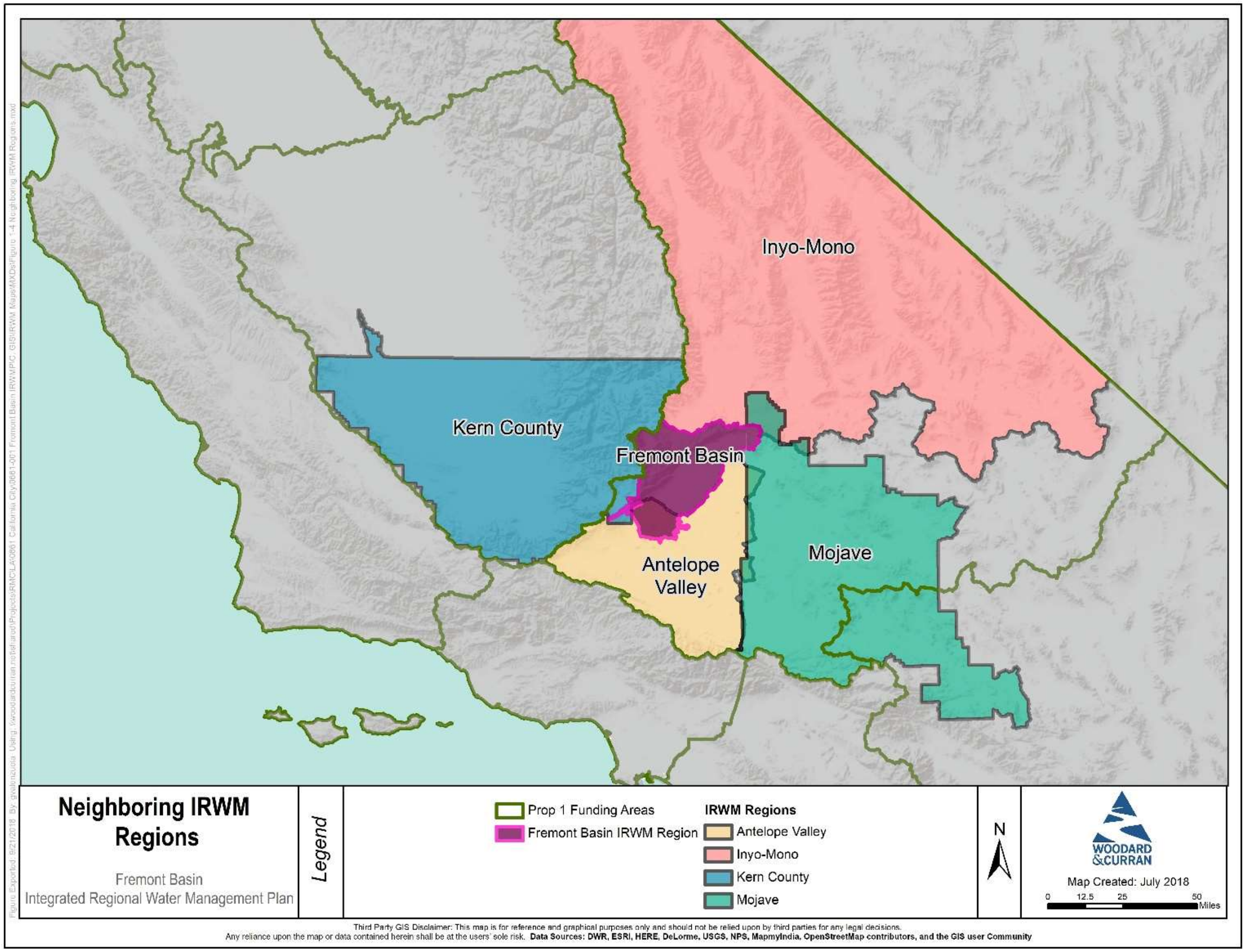
The Inyo-Mono Region is leading the DACI Grant Program for the Lahontan Funding Area. The Fremont Basin RWMG coordinates regularly with representatives from the Inyo-Mono IRWM Region as a part of this program.

Antelope Valley IRWM Region

The Antelope Valley IRWM Region is a part of the Lahontan Funding Area, but this region chose not to submit projects for the DACI Grant Program. The Antelope Valley IRWM Region did coordinate with the Fremont Basin IRWM Region and other Regions in the Funding Area prior to the DACI Grant application process to express their desire not to submit projects and to provide the needed information for the Work Plan.

The Antelope Valley and Fremont Basin IRWM Regions are both a part of the larger Antelope Valley watershed, but have distinct groundwater basins and water management priorities as discussed in *Chapter 2: Region Description*. Two of the Fremont Basin RWMG members, AVEK and MPUD, have service areas that span across both IRWM Regions. Therefore, these two agencies, in addition to other Fremont Basin IRWM stakeholders, attend Stakeholder Meetings for both IRWM Regions and develop projects that provide integration between Regions. The City of California City also has a portion of its City boundary within the Antelope Valley IRWM Region, and coordinates with the Antelope Valley RWMG on data, as needed.

Figure 1-3: Neighboring IRWM Regions



As part of the Fremont Basin IRWM Region boundary modification, the Fremont Basin RWMG coordinated with the Antelope Valley IRWM Region to discuss potential overlapping areas. Following discussions between key RWMG members, the two Regions decided to allow an overlap between the two Regions. Additional coordination will occur, as needed, if any projects in the overlapping areas seek funding through the IRWM Program

Mojave IRWM Region

The Mojave IRWM Region is a participant in the DAC Involvement Grant Program for the Lahontan Funding Area. The Fremont Basin RWMG coordinates regularly with representatives from the Mojave IRWM Region as a part of this program.

As part of the Fremont Basin IRWM Region boundary modification, the Fremont Basin RWMG coordinated with the Mojave IRWM Region to discuss potential overlapping areas and boundary change options. As a result of these discussion, both Regions modified their boundaries according to the Fremont Valley watershed and Cuddeback Valley watershed boundaries so that there is no overlap between Regions.

Kern County IRWM Region

The Kern County IRWM Region was consulted as part of the Fremont Basin IRWM Region boundary modification process. Following multiple correspondences with the Kern County IRWM Region contacts, it was decided that allowing a minor overlap between the Regions was the desired resolution. Additional coordination will occur, as needed, if any projects in the overlapping areas seek funding through the IRWM Program.

1.4.2 Coordination with State, Federal, and Local Agencies

Coordination with government agencies is a necessary component of IRWMP development and project implementation. State agencies, such as DWR, the California Environmental Protection Agency (CalEPA), the California Department of Fish and Wildlife (CDFW), the State Water Resources Control Board (SWRCB), and the Lahontan Regional Water Quality Control Board (LRWQCB) have authority over water resources in the Region and require coordination for permitting and environmental documentation during project development. Federal agencies, such as the U.S. Army Corps of Engineers (USACE), U.S. Fish and Wildlife Service (USFWS), and U.S. Environmental Protection Agency (USEPA) are also involved with permitting and environmental documentation for water-related projects in the Region. Finally, local agencies such as Kern County have authority over land use, public works, and environmental health in the Region.

Several of these agencies, including DWR, the LRWQCB, and Kern County have been contacted directly to invite them to participate in Stakeholder Meetings. The LRWQCB attended several stakeholder meetings during the 2019 Plan development process, and provided guidance and review for the Fremont Valley Basin Salt and Nutrient Management Plan (SNMP). Should State or federal funding be obtained for future IRWMP project implementation, the RWMG will coordinate with the appropriate State and federal agencies. Additionally, ongoing coordination would occur during and after project implementation as part of project monitoring and data collection. As new State, federal and local contacts are identified, they will be added to the Fremont Basin IRWM stakeholder list and invited to future Stakeholder Meetings.

1.5 IRWM 2019 Plan Development

In 2017, the Fremont Basin IRWM Region was awarded a Proposition 1 IRWM Planning Grant to develop its first IRWMP in accordance with DWR's 2016 IRWM Grant Program Guidelines. This funding allowed the Region to establish Regional objectives and targets, assess potential water management strategies, and evaluate and prioritize projects to address the needs of the Region. Funding also supported stakeholder and DAC outreach and involvement as well as the development of a Groundwater Management Plan (GWMP) (provided as Appendix B of this IRWMP) and a SNMP (provided as Appendix C of this IRWMP) to support the technical analyses for the IRWMP.

Extensive outreach efforts were conducted to bolster stakeholder participation during Plan development. Outreach efforts included the development of working groups that focus on various subject areas (see *Section 1.2.2: Governance Structure and Decision Making*), conducting monthly Stakeholder Meetings, and conducting targeted outreach to DACs and tribal groups through emails, phone calls, and media advertisements. During Plan development, the Stakeholder contact list was updated regularly and additional contacts were added to reach underrepresented groups.

1.5.1 Public Notices

The RWMG posted a notice of intent to prepare the Plan in the local newspaper, the Mojave Desert News. The notice was posted on September 1, 2017, and September 8, 2017, in accordance with Section 6066 of the Government Code.

Following development of the IRWM Plan, the RWMG posted notice of the upcoming public review period and public meeting for the draft IRWM Plan in the Mojave Desert News on September 14, 2018 and October 5, 2018. The RWMG will post a notice of intention to adopt the final 2019 IRWM Plan in the Mojave Desert News in accordance with Section 6066 of the Government Code. Each agency adopted the Plan in a public meeting of their respective governing boards. Proof of public notices are provided as Appendix D.

1.5.2 Stakeholder Meetings

Stakeholder Meetings were a key component in the Plan development as they provided an opportunity for stakeholders to contribute information, express concerns, provide recommendations, and relay information to and from their organizations. A series of fifteen Stakeholder Meetings were held leading up to and during the development of the IRWMP. Meeting dates were announced on the Fremont Basin IRWM websites, as well as via email announcements sent to the stakeholder group and local hardcopy postings. Meeting locations are shown in **Figure 1-4**, and meeting topics, dates and locations are summarized in **Table 1-3**.

Figure 1-4: Stakeholder Meeting Locations

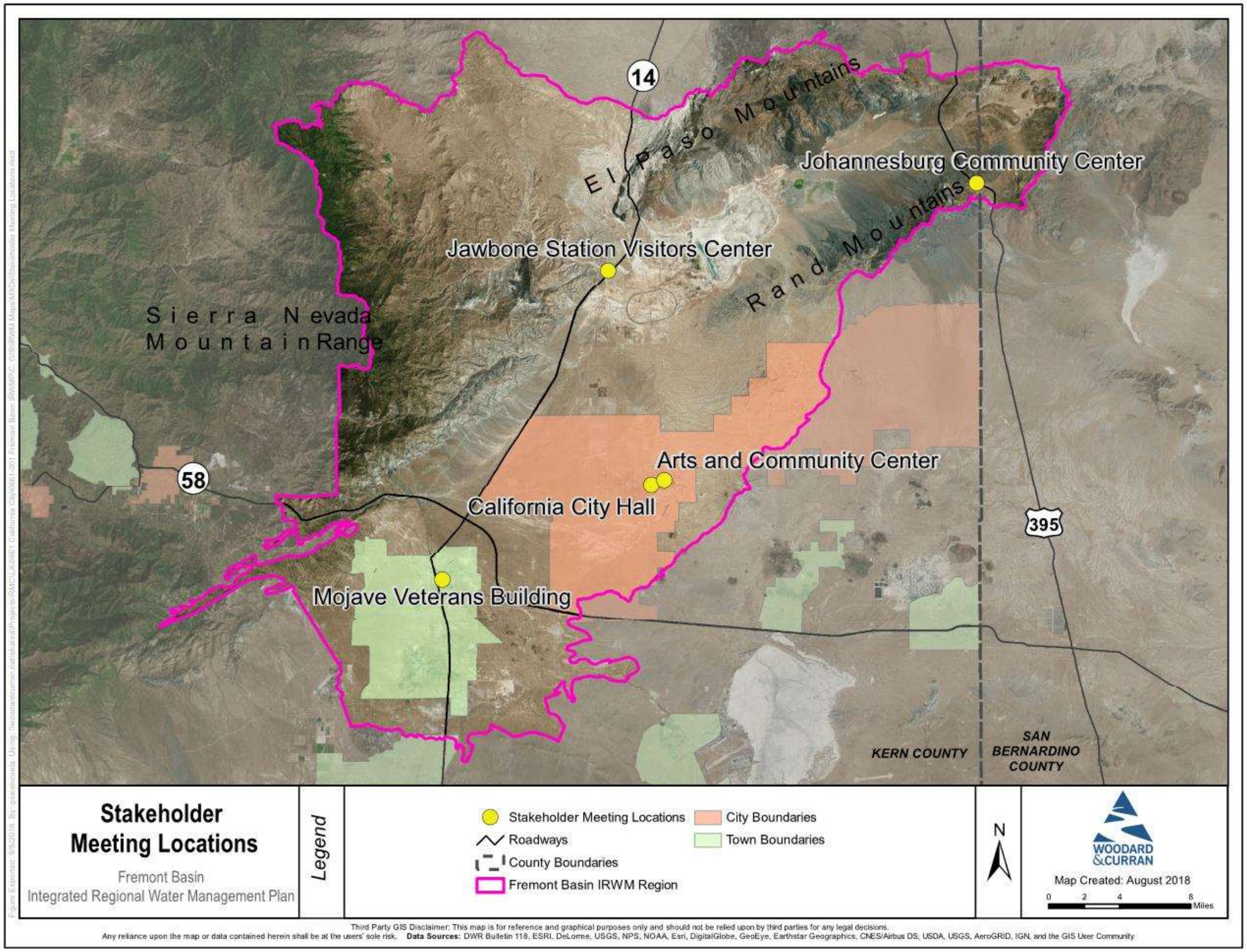


Table 1-3: Fremont Basin IRWM Stakeholder Meetings

#	Meeting Topic/Purpose	Meeting Date	Location
1	IRWM Planning and Grant Program	September 11, 2015	California City Hall, California City
2	IRWM Planning and Grant Program	October 30, 2015	California City Hall, California City
3	IRWM Planning and Grant Program	March 18, 2016	California City Hall, California City
4	Governance	July 27, 2017	Arts and Community Center, California City
5	Region Description	August 15, 2107	California City Hall, California City
6	Region Description cont., Regional Objectives	September 21, 2017	Jawbone Station Visitors Center, Cantil
7	Supply and Demand, Region Objectives	October 19, 2017	Mojave Veterans Memorial Building, Mojave
8	Objectives and Targets, Regional Management Strategies	November 16, 2017	Johannesburg Community Center
9	Climate Change	December 14, 2017	Arts and Community Center, California City
10	Project Review and Prioritization	January 18, 2018	California City Hall, California City
11	Project Prioritization and Scoring	February 15, 2018	Mojave Veterans Memorial Building, Mojave
12	Plan Implementation	March 15, 2018	Jawbone Station Visitors Center, Cantil
13	Draft GWMP	August 23, 2018	California City Hall, California City
14	Draft SNMP	September 20, 2018	Mojave Veterans Memorial Building, Mojave
15	Draft IRWM Plan	October 11, 2018	Arts and Community Center, California City

1.5.3 DAC Outreach for Plan Development

Outreach to DACs was an integral part of the IRWM 2019 Plan development. More than 90 percent of the Fremont Basin IRWM Region lies either within a block group, tract, or Census Designated Place that has a median household income (MHI) below 80% of the State's MHI and is classified as a DAC as discussed in *Chapter 2: Region Description*. A few groups were identified by the RWMG as key DAC representatives for the Region that could provide specific input on DAC water management issues and needs. These groups included representatives from Rand Communities Water District (RCWD), Rancho Seco, Cantil, Mojave, and the Eastern Kern County Resource Conservation District.

1.5.4 Media

The local newspaper, the Mojave Desert News, attended multiple Stakeholder Meetings and provided some coverage in the paper about the IRWM Plan development during the planning process. In addition to the newspaper articles, the RWMG posted notices of Plan preparation and Plan adoption in the Mojave Desert News.

1.5.5 Plan Adoption

Following completion of the 2019 IRWM Plan, the Plan was adopted by each of the three IRWM agencies: City of California City, MPUD, and AVEK. Several project proponents who submitted projects to the IRWM Plan intend to adopt the Plan including Rancho Seco Inc.

1.6 Technical Analysis

The RWMG used technical data and analyses to help understand and describe the water management needs in the Region over the planning horizon of 25 years. The technical analyses referenced or conducted in support of the IRWM Plan are summarized in **Table 1-4**.

Table 1-4: Technical Analyses

Data or Study	Analysis Method	Results/Derived Information	Use in IRWM Plan
2015 Urban Water Management Plans for City of California City[1], AVEK[2], and California Water Service[3]	Analysis of water supply reliability, water quality, water demands, and infrastructure	Current and projected supplies and demands, quality concerns, and facility descriptions	Used to describe current and projected supplies and demands in the Region, discuss drinking water quality concerns, and facilities. Also, used to identify water supply issues and needs.
2012-2016 American Census Survey (ACS) (US Census Bureau)[4]	Review of median household income for block groups, tracts and designated places	Housing and income data for the 5-year period from 2012 to 2016	Used to estimate median household income and DAC locations
1990/2000/2010/2015 Census (US Census Bureau)[5]	Review of census block groups, tracts and designated places	Populations and housing data for the year 2010 and 2015	Used to estimate current population for the Region, and calculate demand
Department of Finance[6]	Growth analysis	Demographics and population projections for unincorporated Kern County for the period 2010 to 2040	Used to determine demographics in the Region, estimate population growth, and calculate potential future demands
Basin Plan for the Lahontan Region[7]	Water quality analysis	Beneficial use designations and water quality objectives	Used to describe current water quality impairments, beneficial uses for surface waters, and quality objectives for surface and ground waters

Data or Study	Analysis Method	Results/Derived Information	Use in IRWM Plan
Fremont Valley Basin Groundwater Management Plan[8]	Groundwater elevation analysis, water quality issue identification	Estimates of natural recharge for the Fremont Valley Groundwater Basin and potential water quality issues	Used to describe groundwater supplies and quality condition and to estimate groundwater supply capacity to support increases in demands
Fremont Valley Basin Salt and Nutrient Management Plan[9]	Loading and antidegradation analysis	Assimilative capacity for the Fremont Valley Groundwater Basin and potential impacts of future development on groundwater quality	Used to describe potential impacts on groundwater quality from projected changes in land use
California Energy Management Information System[10]	Climate Change Analysis	Climate data for the Region	Used to describe current and projected climate conditions
Cal-Adapt[11]	Climate Change Analysis	Climate change impacts on temperature, extreme heat days, wildfire risk, and precipitation in the Region through 2100	Used to describe climate change impacts on the Region

Sources: (1) California City Water Department. 2017. Urban Water Management Plan 2015 Update; (2) AVEK. 2016. 2015 Urban Water Management Plan; (3) California Water Service. 2016. 2015 Urban Water Management Plan; (4) American Community Survey (ACS). 2015. 2012-2016 ACS 5-Year Estimates; (5) United States Census Bureau. 2010. 2010 United States Census Demographics; (6) California Department of Finance. 2017. County Population Projections (2010-2060); (7) SWRCB Division of Drinking Water. 2015. Basin Plan for the Lahontan Region, 1995 with amendments effective through September 2015; (8) Woodard & Curran. 2018a. Fremont Valley Basin GWMP; (9) Woodard & Curran. 2018b. Fremont Valley Basin SNMP; (10) California Emergency Management & Natural Resources Agency. 2012. California Adaptation Planning Guide; (11) California Energy Commission. 2017. Cal-Adapt Tools.

1.7 Relation to Local Water and Land Use Planning

The Fremont Basin IRWM Plan was developed to be consistent with other local planning efforts being conducted in the Region. As discussed previously, the Fremont IRWM Plan was developed with input from a variety of regional stakeholders, including stakeholders with jurisdiction over local water and land use planning. The RWMG itself is composed of the three major water agencies in the Region, with one member, the City of California City, also being a local land use planning agency. Other water and land use planning agencies, such as Kern County, were consulted during the development of the Plan and invited to Stakeholder Meetings to ensure consistency and collaboration between planning efforts. Stakeholder Meetings will continue to be an avenue for coordination between the RWMG and local land use and water planning agencies.

Kern County was consulted during Plan development via email and phone calls to ensure updated information, consistent with water and land use planning in the unincorporated areas of the Region, was included in the Plan. The County's involvement supports coordination that ensures information is translated between local and regional planning efforts. The Fremont Basin IRWM Region recognizes the importance of maintaining clear and consistent communication with the County and will continue to try to involve the County in the Region's IRWM planning efforts as the Plan is implemented and updated. The importance of the coordination between local and regional water and land use is further supported by the inclusion of this collaboration as one of the Regional Objectives and planning targets as described in *Chapter 4: Objectives*.

The following sections highlight the local water and land use planning efforts that relate to the Fremont Basin IRWMP.

1.7.1 Groundwater Management Plan

The FVGB is currently designated as a low priority groundwater basin under the Sustainable Groundwater Management Act (SGMA); thus, the agencies within the IRWM Region are not subject to SGMA requirements for the groundwater basin at this time. However, the City, AVEK, and MPUD initiated efforts to prepare the Region for development of a Groundwater Sustainability Plan (GSP) through the development of a GWMP for the FVGB. The Fremont Valley Basin GWMP was developed in coordination with the development of the Fremont Valley Basin SNMP and Fremont Basin IRWMP. The GWMP is intended to act as a "pre-GSP" document to later be revised to meet the requirements of SGMA. The City, AVEK, and MPUD, as well as other key stakeholders in the Region, may form a Groundwater Sustainability Agency (GSA) in the future and continue the GSP development process.

The City and Regional stakeholders recognize that cooperation across agencies involved in the basin management is essential to long-term groundwater basin sustainability, to supporting the new GWMP goals and objectives, and to streamlining data collection and reporting efforts from agencies involved in GWMP implementation. Therefore, the Fremont Valley Basin GWMP, SNMP and Fremont Basin IRWMP were developed in close coordination, utilizing similar objectives, management strategies, and projects to meet planning area goals.

1.7.2 Salt and Nutrient Management Plan

A SNMP was prepared for the FVGB to fulfill the requirements of the State's Policy for Water Quality Control for Recycled Water (Recycled Water Policy). The Fremont Valley Basin SNMP development was led by the City, AVEK, and MPUD, in collaboration with local and regional stakeholders and in accordance with the Recycled Water Policy. The primary purpose of the SNMP was to assist the City, AVEK, MPUD, and stakeholders in complying with the Recycled Water Policy regarding the use of recycled water from municipal wastewater treatment facilities. The Recycled Water Policy supports use of recycled water as a source of water supply while requiring the management of salts and nutrients from all sources on a sustainable basis to maintain water quality objectives and protect beneficial uses covered by each of the Regional Water Quality Control Board Basin Plans.

Recycled water is currently used in the City's Central Park Lake and is served to irrigate park and golf course areas, as discussed in *Chapter 2: Region Description*. Recycled water supply is projected to increase in the future as the City's population grows and the City expands its wastewater treatment plant. The Fremont Valley Basin SNMP is intended to inform future decisions for the use of recycled water and help streamline permitting of future recycled water projects while protecting the basin water quality objectives and beneficial uses. Information regarding the feasibility of recycled water expansion in the Region and its impact on the groundwater basin was incorporated into the IRWM Plan.

1.7.3 Urban Water Management Plans

Urban Water Management Plans (UWMPs) are prepared by urban water suppliers to support long-term resource planning and ensure adequate water supplies are available to meet current and future water demands in their service areas. Preparation of an UWMP is a requirement of the Urban Water Management Planning Act for urban water suppliers with 3,000 or more connections or supplying more than 3,000 acre-feet (AF) of water annually. These plans must be updated and submitted to DWR every 5 years to comply with the Act and be eligible for State funding.

The UWMPs for the urban water suppliers in the Region were used to help describe and calculate the water supplies and demands in the Region. Both the City of California City and AVEK completed UWMPs in 2015 (California City Water Department 2017; AVEK 2016). These documents are a valuable tool for resource planning, including supply and demand management. The most recent UWMP prepared by MPUD was submitted to DWR in 2004 (MPUD 2004). Since that time, they have not been required to complete an UWMP because they have less than 3,000 connections and supply less than 3,000 AF of water annually. Information from UWMPs will be incorporated in future IRWMP updates as it becomes available.

1.7.4 City and County General Plans

California law requires that each city and county in the State develop and adopt a general plan. General plans are comprehensive long-term plans for the physical development of the plan area and contain a list of development goals and policies for the county or city. The seven mandated elements of a general plan are: Land Use, Open Space, Conservation, Housing, Circulation, Noise, and Safety.

In 2009, the City Council of the City of California City adopted an updated General Plan. The General Plan outlines the vision for the City's future and includes implementation measures to meet the vision. Planning and development decisions are made consistent with the goals and policies delineated in the General Plan. The planning area is comprised of the City's corporate limits, totaling 130,200 acres of land located on the western edge of the Mojave Desert in eastern Kern County (California City 2009).

In 2004, Kern County adopted its General Plan and has completed several updates since then. The County General Plan's Land Use, Open Space, and Conservation element designates the proposed general distribution, location, and extent of land uses in unincorporated areas. The focus of the discussion is on ensuring future economic growth while conserving the County's agricultural, natural, and resource attributes (Kern County 2009).

Both the City and County General Plans were used to help describe the current and future land use conditions in the Region. The City of California City and the Kern County Planning and Natural Resources Department were consulted during Plan development to ensure current land use planning initiatives and processes were incorporated.

1.7.5 Regional Conservation Plans

The IRWM Region provides critical habitat for diverse flora and fauna that have adapted to high desert conditions. To protect the area's biodiversity and ecosystem, various restoration efforts are underway. The CDFW, the California Department of Transportation, local jurisdictions, and other regional stakeholders collaborated with the United States Bureau of Land Management (BLM) to develop the West Mojave Plan in 2005. The plan is a habitat conservation and federal land use plan that provides management strategies for the desert tortoise, Mohave ground squirrel, and over 100 other plants and animals that are vital for the preservation of these two species. The planning area is located to the north of the Los Angeles metropolitan area and includes the IRWM Region within its boundaries.

The West Mojave Plan was used to help identify conservation areas in the Region and describe potential habitat issues and needs.

1.7.6 Stormwater Resource Plans

The development of a Stormwater Resource Plan (SWRP) is required in order to receive State funding for any stormwater and dry weather runoff capture project, with some exceptions[1]. SWRPs must be incorporated into IRWMPs as part of compliance with Water Code Section 10562(b)(7) requirements. Currently, there are no SWRPs in the IRWM Region and no plans to develop any by municipalities in the Region. If any SWRP is developed in the Region in the future, the RWMG will incorporate the SWRP into the Plan, as applicable.

1.8 Plan Update Process

The IRWMP is a "living document" that will be updated regularly. As the Region continues to develop and regulatory requirements continue to evolve, it is expected that many components of the Plan will change and need revision. Adaptive management processes will be used to ensure the Plan remains relevant and useful for regional planning. For example, the Region may decide to update the plan to include:

- New water-related issues and needs
- New or modified objectives and targets
- New Plan projects and project prioritization
- Progress on Plan performance and/or project monitoring
- New local planning efforts

It is also anticipated that the RWMG will update the Plan to meet changing DWR requirements as funding becomes available. With this in mind, the RWMG plans to update the IRWMP no less than every five years to keep the Plan reflective of current regional issues, objectives, and water management strategies.

[1] SWRPs are not required of DACs with a population of 20,000 or less that are not a co-permittee for a Municipal Separate Stormwater System National Pollutant Discharge Elimination System permit issued to a municipality with a population greater than 20,000.

Future Plan updates will be coordinated through the RWMG and be similar in process to the Plan development process described previously in this document. Formal changes to the Plan may reflect significant changes to processes, organizational structure, water management conditions, or routine periodic updates of the Plan. For formal updates, Stakeholder Meetings will be conducted to ensure stakeholders, including DACs and tribal communities, are involved. The Fremont Basin IRWM websites and stakeholder email list will be used to communicate with stakeholders about meetings and Plan updates. Once an update is complete, RWMG member agencies will re-adopt the updated Plan, which will then be posted on the Region's websites.

Informal changes to material/content in the Plan such as minor processes, or water management changes that occur frequently, will not require a formal Plan update as they will not require decisions to be made by the RWMG. These changes will be included in the periodic Plan updates. Because projects will continue to be submitted to the RWMG for inclusion in the IRWM Project list between Plan updates, the RWMG will continue to review and update the IRWM project list, and post it to the webpage housed on the City of California City's website. The project review process is described in detail in *Chapter 6: Projects*.

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2 Region Description

2.1 Regional Overview

This chapter provides an overview of the Fremont Basin IRWM Region, including the physical characteristics, sources of supply and estimated demands, water quality, land use, and the social and cultural setting.

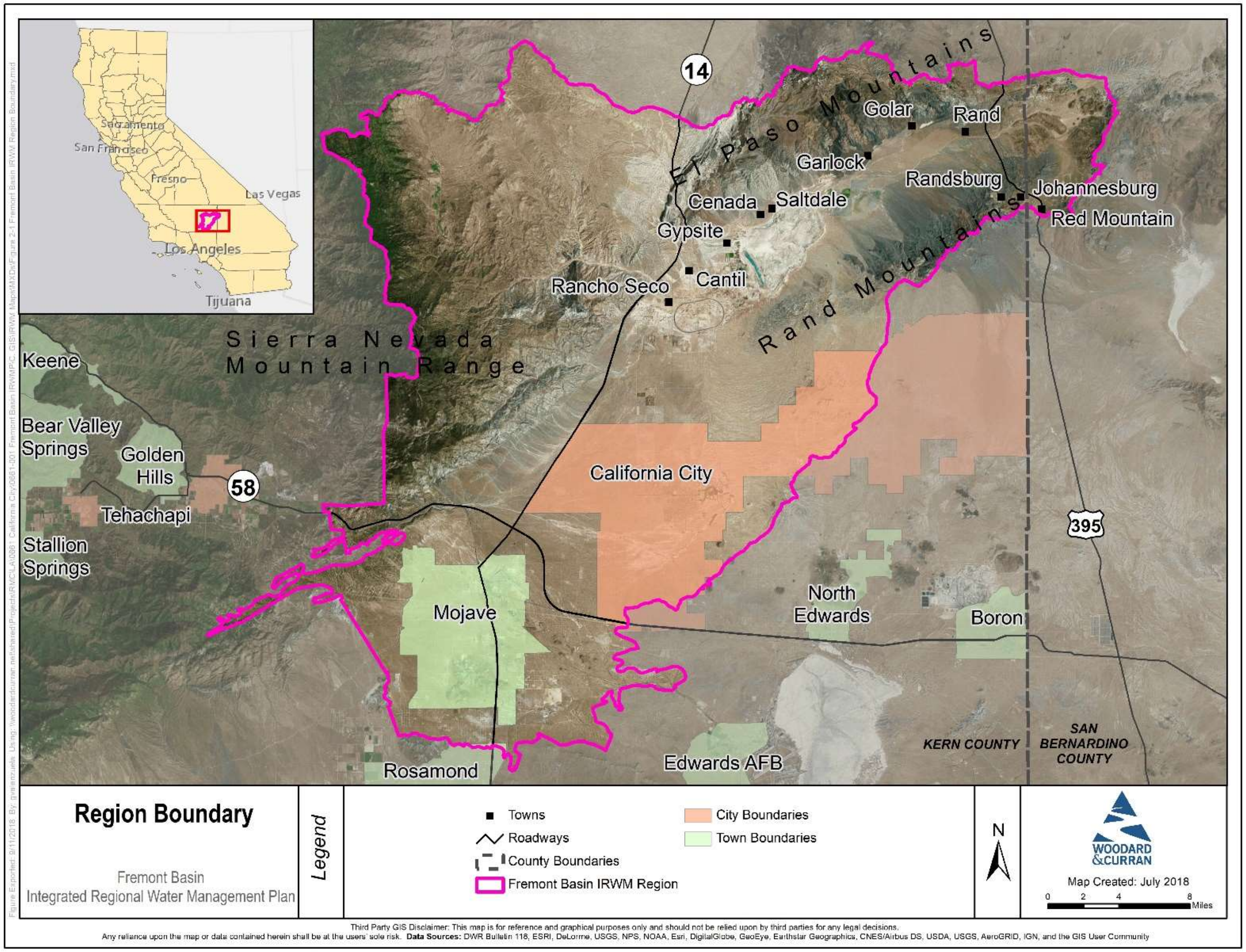
2.1.1 Fremont Basin IRWM Regional Boundary

The Fremont Basin IRWM Region is located in eastern Kern County and western San Bernardino County, within a distinct drainage basin (watershed) in the southern half of the Lahontan Hydrologic Region. The Region is bounded by the Antelope Valley to the south, the Rand Mountains to the north, the southern ranges of the Sierra Nevada Mountains to the west, and San Bernardino County to the east (see **Figure 2-1**). The City of California City, located on the western edge of the Mojave Desert, is the only Incorporated Place within the Region. Unincorporated communities in the Region include the town of Mojave (a Census Designated Place) as well as the small communities of Cantil, Rancho Seco, Gypsite, Ceneda, Saltdale, Garlock, Rand, Goler, Johannesburg, Randsburg, and Red Mountain. Major highways giving access to the Region include State Route 14, a north-south aligned highway that traverses the entirety of the Region, and State Route 58, a south-east aligned highway that crosses between Mojave and California City. The California City Municipal Airport, a 222-acre publicly owned facility located in California City, also provides access to the Region.

The IRWM Region boundaries were originally created to fill the existing void created by neighboring IRWM regions, which include Inyo-Mono, Kern County, Antelope Valley, and Mojave. This boundary was established through the RAP, approved by DWR in 2011. In 2018, the Fremont Basin IRWM Region boundaries were expanded to better represent the common water management needs in the Region. The revised IRWM boundaries now encompass 992-square miles and are a combination of the natural topography that outlines the Fremont Valley watershed and the FVGB. Though topographic considerations and jurisdictions were essential for the formation of the Region boundary, it also reflects water management issues, stakeholders, and water-related conflicts.

In addition, the Region may be identified by its unique water management priorities and issues, including those related to water supply, water quality, flood management, and environmental stewardship. Water resource planning at the regional level is useful for coordinating efforts to address these issues and help meet water demands with an integrated water supply portfolio while considering the unique characteristics of the Region. These unique characteristics are described in the sections that follow.

Figure 2-1: Fremont Basin IRWM Region Boundary



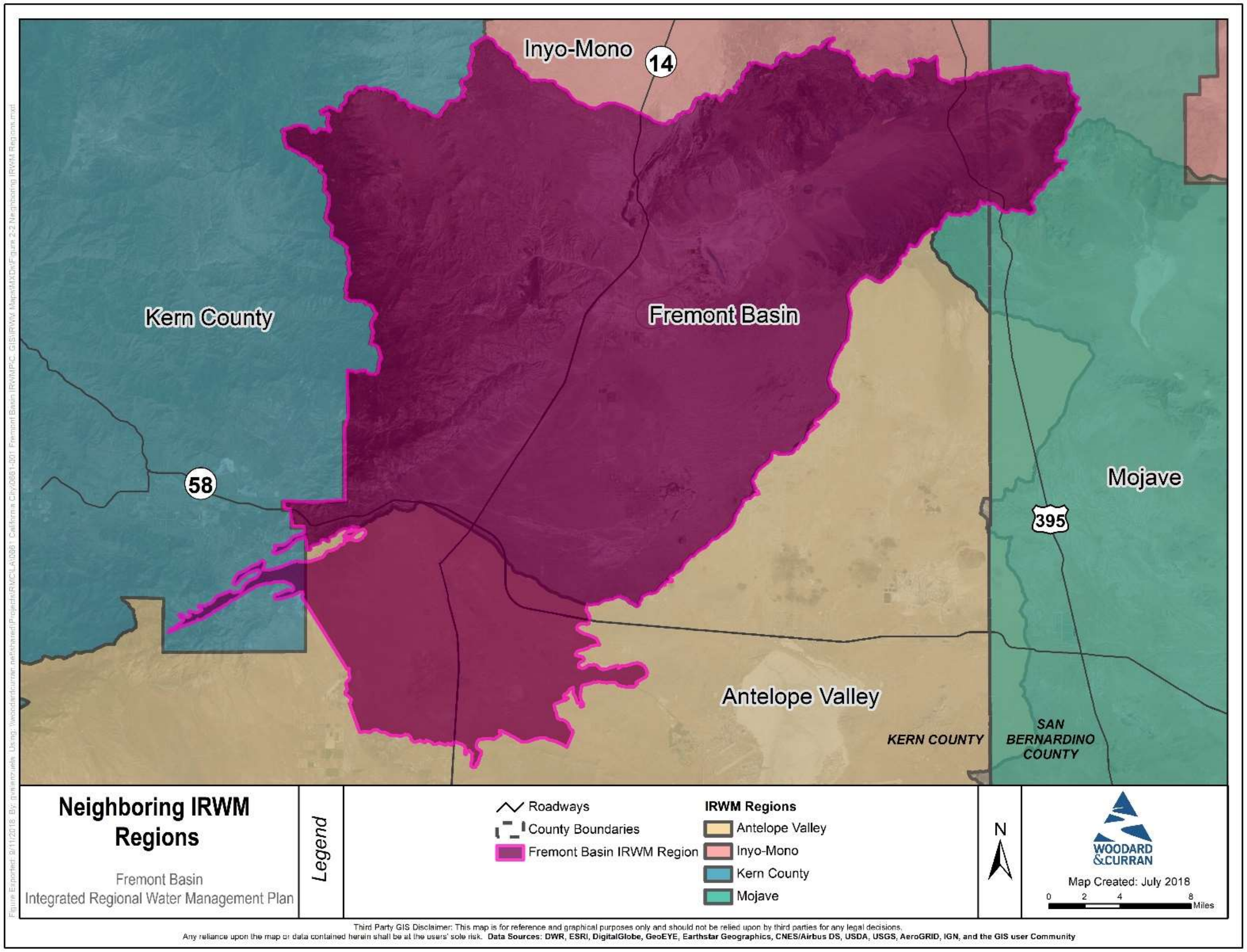
2.1.2 Neighboring IRWM Regions

As discussed in *Chapter 1: Governance and Planning*, the Fremont Basin IRWM Region is located in DWR's Proposition 1 Lahontan Funding Area. The Lahontan Funding Area encompasses 25,513 square miles along the eastern edge of the state of California. Within the Lahontan Funding Area, there are six individual IRWM Regions, including Fremont Basin, Mojave, Inyo-Mono, Antelope Valley, Tahoe Sierra, and Lahontan Basins. As shown in **Figure 2-2**, Fremont Basin is surrounded by the following four IRWM Regions:

- Inyo-Mono IRWM Region to the north; first IRWMP was adopted in 2010;
- Kern County IRWM Region to the west; first IRWMP was adopted in 2011;
- Antelope Valley IRWM Region to the south; first IRWMP was adopted in 2007; and
- Mojave IRWM Region to the east; first IRWMP was adopted in 2014.

The Region currently overlaps with both the Kern County and the Antelope Valley IRWM Regions. In the southwestern portion of the Fremont Basin IRWM Region, there exists a 4,700-acre overlap with the Kern County IRWM Region. In the southeastern portion of the Fremont Basin IRWM Region, there exists a 106,400-acre overlap with the Antelope Valley IRWM Region. These overlapping areas resulted after the Fremont Basin IRWM Region modified its boundary in 2018 to include the entirety of the FVGB, as described in *Chapter 1: Governance and Planning*.

Figure 2-2: Neighboring IRWM Regions



2.2 Physical Setting

2.2.1 Climate

The Fremont Basin IRWM Region is located in the high desert at an elevation of 2,300 to 4,000 feet above mean sea level (msl). The climate is semiarid and characterized by warm, dry summers and mild, cool winters. The mean daily temperatures range from 33°F in the winter to 98°F in the summer (Western Regional Climate Center N.D.). Native flora in the Region is dominated by sparse, drought-resistant vegetation that can tolerate both extreme heat and cold weather. Examples include Joshua trees, mesquite, sagebrush, desert cymopterus, and Mojave Creosote bush scrub. Carpets of wildflowers bloom during wet years, depending on rainfall intensity in the spring (City of California City N.D.a).

Joshua trees are a common vegetation type in the semiarid Fremont Basin IRWM Region

Average monthly precipitation in the Region ranges from 0.03 inches in June to 1.3 inches in February. The total annual average rainfall is 5.9 inches, with 70 percent of precipitation occurring between December and March and little to no rainfall in the summer months (California Irrigation Management System (CIMIS) N.D.). Because of the lack of rain during the summer months, water demand for landscaping and non-native plants increases.

Monitoring data indicates that the Fremont Valley area has experienced wet-dry cycles with a prolonged drought period from 1945 to 1964, a prolonged wet period from 1976 to 1984, and a drought period 2006 to the present. Precipitation on the valley floor may have significant losses from evaporation and transpiration; however, during an exceptionally wet season, flashfloods may occur and runoff may originate on or cross the valley floor to reach Koehn Lake located in the northeastern part of the Region (Stetson 2009). Precipitation is greater in the mountains than on the valley floor, with rainfall ranging from 2.5 inches to 27.8 inches and an average of approximately 10.1 inches annually (National Oceanic and Atmospheric Administration 2018).

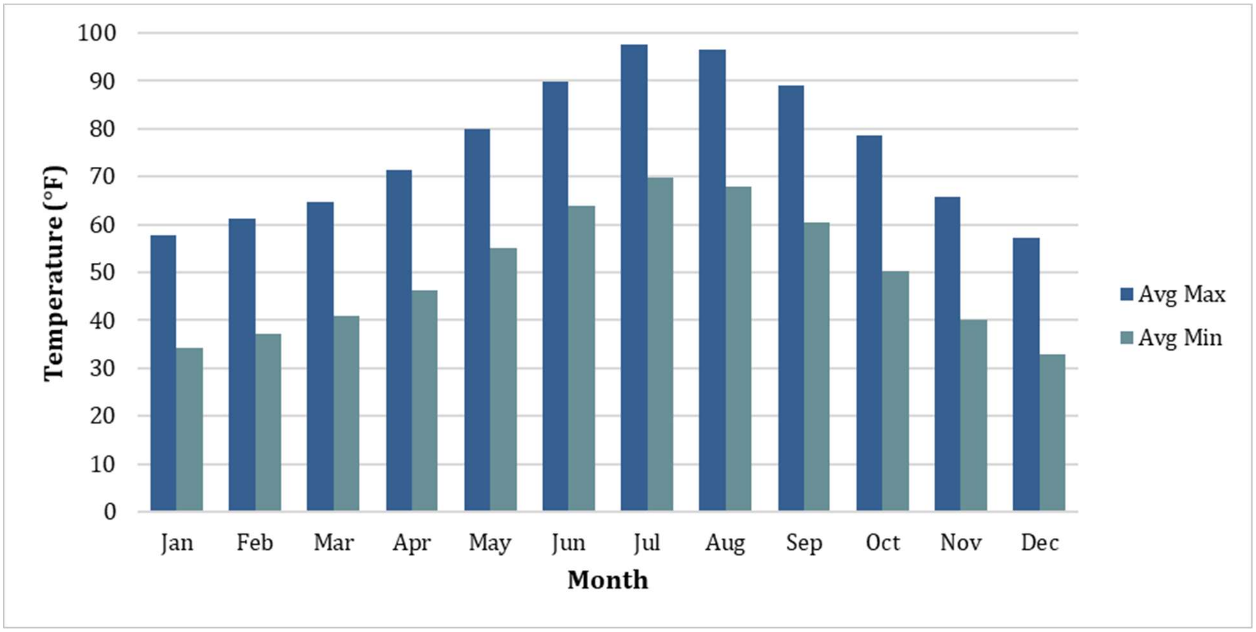
Table 2-1 presents a summary of the Region's climate based on data collected at the Mojave Station between 1904 and 2016. **Figure 2-3** indicates the average minimum and maximum temperatures in the Region and **Figure 2-4** indicates the average rainfall and monthly evapotranspiration (ETo) in the Region.

Table 2-1: Climate in the Fremont Basin IRWM Region

Month	Average Monthly ETo (inches)[1]	Average Rainfall (inches)[2]	Average Maximum Temperature (˚F)[2]	Average Minimum Temperature (˚F)[2]
January	2.31	1.20	57.8	34.2
February	3.16	1.27	61.2	37.1
March	5.01	0.93	64.7	41.0
April	6.47	0.30	71.3	46.3
May	8.28	0.09	79.9	55.1
June	9.19	0.03	89.9	63.8
July	9.61	0.11	97.6	69.7
August	8.74	0.15	96.4	68.0
September	6.35	0.21	89.0	60.3
October	4.48	0.24	78.5	50.3
November	2.85	0.53	65.7	40.2
December	2.07	0.87	57.2	32.9
Annual	**68.52**	**5.93**	**75.8**	**49.9**

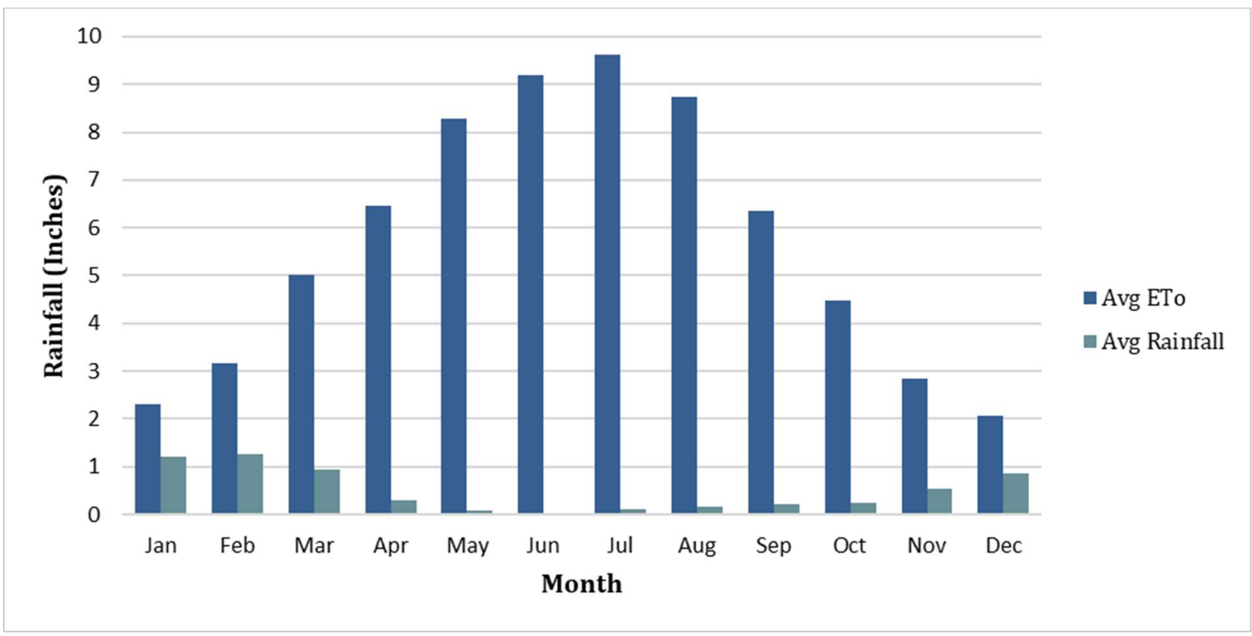
Sources: (1) CIMIS Data for Palmdale No. 197 Station since April 2005. Accessed 9 August 2017 from www.cimis.water.ca.gov/Stations.aspx (2) Western Regional Climate Center, Mojave Station (045756) for the Years 1904 to 2016.

Figure 2-3: Average Monthly Temperature in the Fremont Basin IRWM Region



Source: Western Regional Climate Center, Mojave Station (045756) for the Years 1904 to 2016.

Figure 2-4: Average Monthly Rainfall and Evapotranspiration (ETo) in the Fremont Basin IRWM Region



Sources: CIMIS Data for Palmdale No. 197 Station since April 2005; Western Regional Climate Center, Mojave Station (045756) for the Years 1904 to 2016.

2.2.2 Geology and Soils

The FVGB underlies the majority of the IRWM Region and is the primary water feature for the Region. The groundwater basins in the Region and their boundaries are discussed in *Section 2.3.3: Groundwater*. The geological structures and soils in the Region were described in detail as part of the Fremont Valley Basin GWMP and are summarized below. For a more detailed description of the geological setting, see the Fremont Valley Basin GWMP in Appendix B.

Mountains surrounding the Fremont Valley

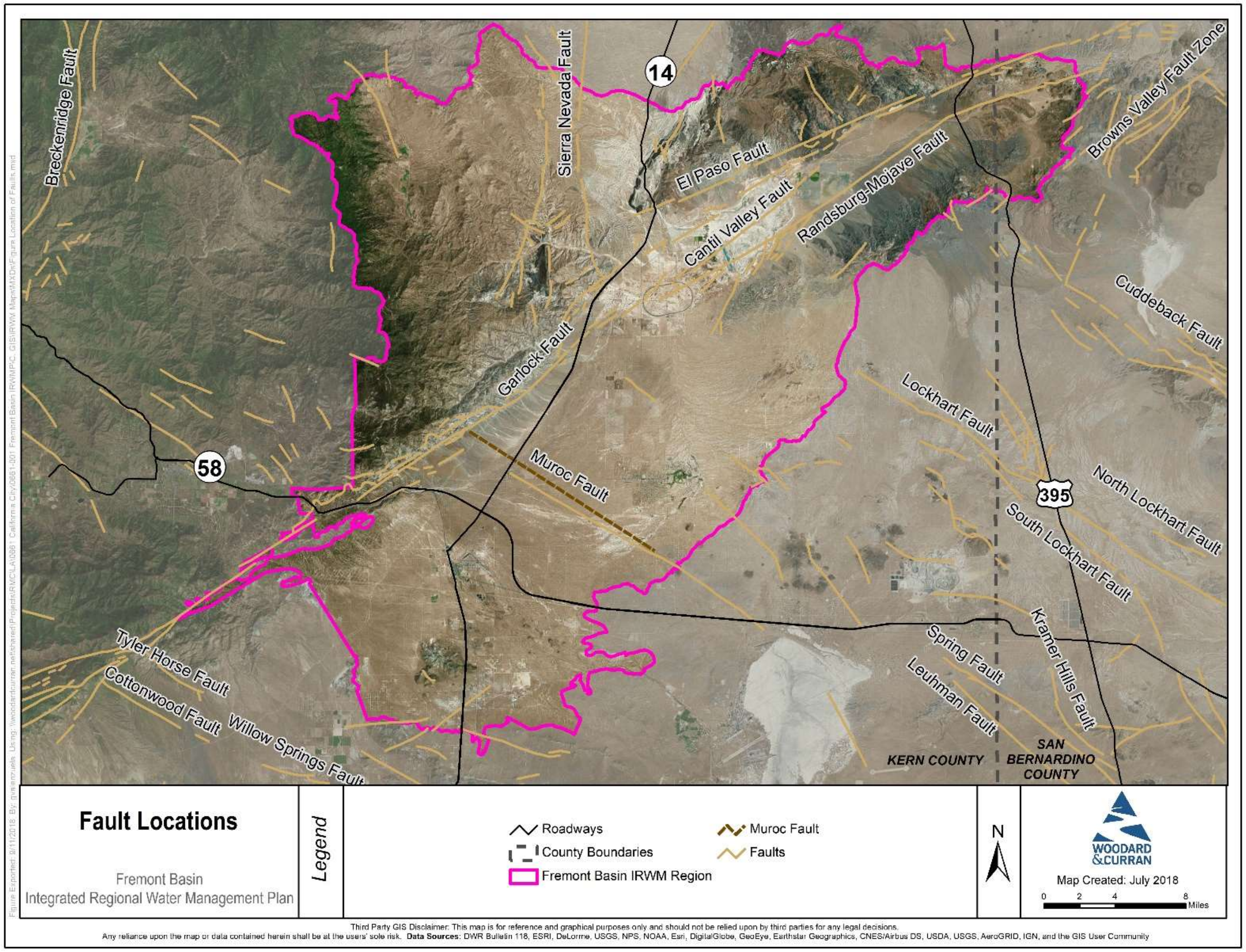
Structural Features

Several named and unnamed faults in the FVGB are identified on California geologic maps, as shown on **Figure 2-5**. Four major faults transverse the FVGB in a northeast-trending direction. The longest ones are the Garlock fault and El Paso fault system that run along the north and west sides of the basin, along the foothills of the Sierra Nevada and El Paso Mountains, and separates the consolidated rocks of the Tehachapi, Piute, and El Paso Mountains from the FVGB. The Cantil Valley fault, which appears to be a branch of the Garlock fault, runs from the Garlock fault near the town of Cantil, bisects the FVGB through Koehn Lake, and rejoins the Garlock fault approximately nine miles east of US 395. According to the DWR, the effects of the Cantil Valley fault on groundwater flow are not known; but the U.S. Geological Survey (USGS) and recent studies indicate that it serves as a partial barrier to groundwater flow (USGS 1977).

The Randsburg-Mojave fault runs along the northeastern side of the basin and separates the consolidated rocks of the Rand Mountains from the FVGB. The southern boundary of the FVGB is bounded on the south by the east-west trending Rosamond fault. These faults form restrictive groundwater barriers on the west and northwest sides of the FVGB (Dibblee 1967).

The Muroc fault traverses the southern portion of the FVGB and forms a partial barrier to groundwater flow (DWR 1964). Previous studies by Stetson (2009) considered the Muroc fault as an intrabasin boundary dividing the basin into two subbasins: the California City subbasin to the north and the Mojave City subbasin to the south. The subsurface flow across the Muroc fault is reported to occur only when groundwater levels south of the fault are high enough to allow groundwater to overflow the groundwater barrier created by the fault. The subsurface flow appears to stop when groundwater levels south of the Muroc fault are lower than the barrier crest, which is estimated at an elevation of approximately 2,420 feet msl based on historical water levels near the Muroc fault.

Figure 2-5: Location of Faults in the Fremont Valley Groundwater Basin



Soils

Soil data for the Plan area were obtained from the U.S. Department of Agricultural (USDA) SSURGO and STATSGO2 databases. Data are discussed based on hydrologic soil groups as shown in **Figure 2-6**. Hydrologic soil groups are assigned based on measured rainfall, runoff potential, and infiltration. Soils groups vary from low runoff potential and high permeability (group A) to soils with high runoff potential and low permeability (group D). According to the data, most soils in the Plan area are either group A or group D with small areas of group B and group C. Areas with soils in group A and higher saturated hydraulic conductivities are more likely to be the potential recharge areas for the underlying groundwater basin, as discussed in the Fremont Valley Basin GWMP in Appendix B, though there may also be site-specific constraints to recharge, depending on land use or other factors.

Due to the high sand content and sparse rainfall in the Region, some portions of the Fremont Valley experience dust issues. Low rainfall and strong winds cause sand to blow and erode soils. This issue is prominent near the communities of Rancho Seco and Cantil in the northern Fremont Valley where sand dunes can cause damage to homes and roads. Sand management and restoration is an ongoing concern for the communities in this area.

2.2.3 Watersheds and Surface Water Features

The Fremont Basin IRWM Region is composed primarily of the Fremont Valley watershed in addition to including a portion of the Antelope Valley watershed in the southern portion of the Region. The Region is surrounded by the remaining portion of the Antelope Valley watershed, as well as the Grapevine, Kern River, Indian Wells Valley, Trona, and Cuddeback watersheds, as shown in **Figure 2-7.**

The portions of the Fremont Valley watershed not included in the IRWM Region are located west of the Kern County IRWM Region boundary. The Fremont Valley watershed is part of the larger Antelope-Fremont Valleys watershed, (Hydrologic Unit Code 18090206). The subwatersheds of the Fremont Valley watershed include the Koehn, East Tehachapi, Kelson Landis, and Dove Springs subwatersheds as shown in **Figure 2-8**.

Koehn Lake, the dry lake bed in the Region

The Fremont Valley watershed is a dry, closed basin area surrounded by mountain ranges that receives surface water runoff from Pine Tree Canyon, Cache Creek, and other ridges adjacent to the area. Surface runoff drains from the surrounding mountains and valley to Koehn Lake, a dry lake bed where the water either evaporates or percolates into the ground. The dry lake bed is located north of California City and is the lowest topographical location in the basin, with a bed elevation of approximately 1,880 feet above msl. In addition to natural surface water features, the Los Angeles Aqueduct passes through the Region, as a subterranean pipe, from the northern to the southern boundaries. These surface water features are also shown in **Figure 2-7**.

There is a small portion of the Antelope Valley watershed in the southern portion of the Region. This portion of the Antelope Valley watershed includes the town of Mojave and receives runoff from the San Gabriel Mountains. The primary subwatersheds of the Antelope Valley watershed within the Region include the Chaffee and Gloster subwatersheds as shown in **Figure 2-8**.

Figure 2-6: Hydrologic Soil Groups

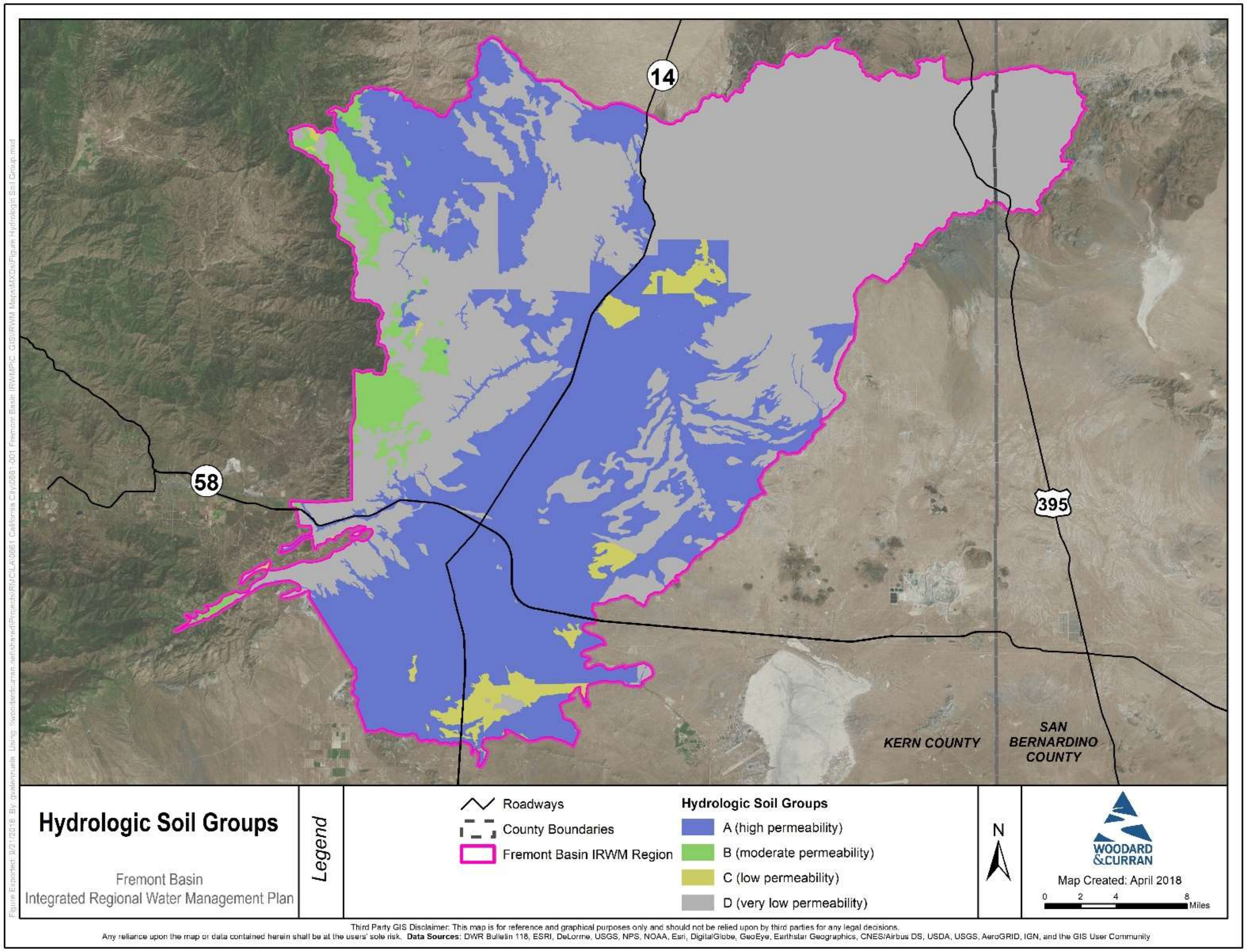


Figure 2-7: Watersheds and Surface Water Features

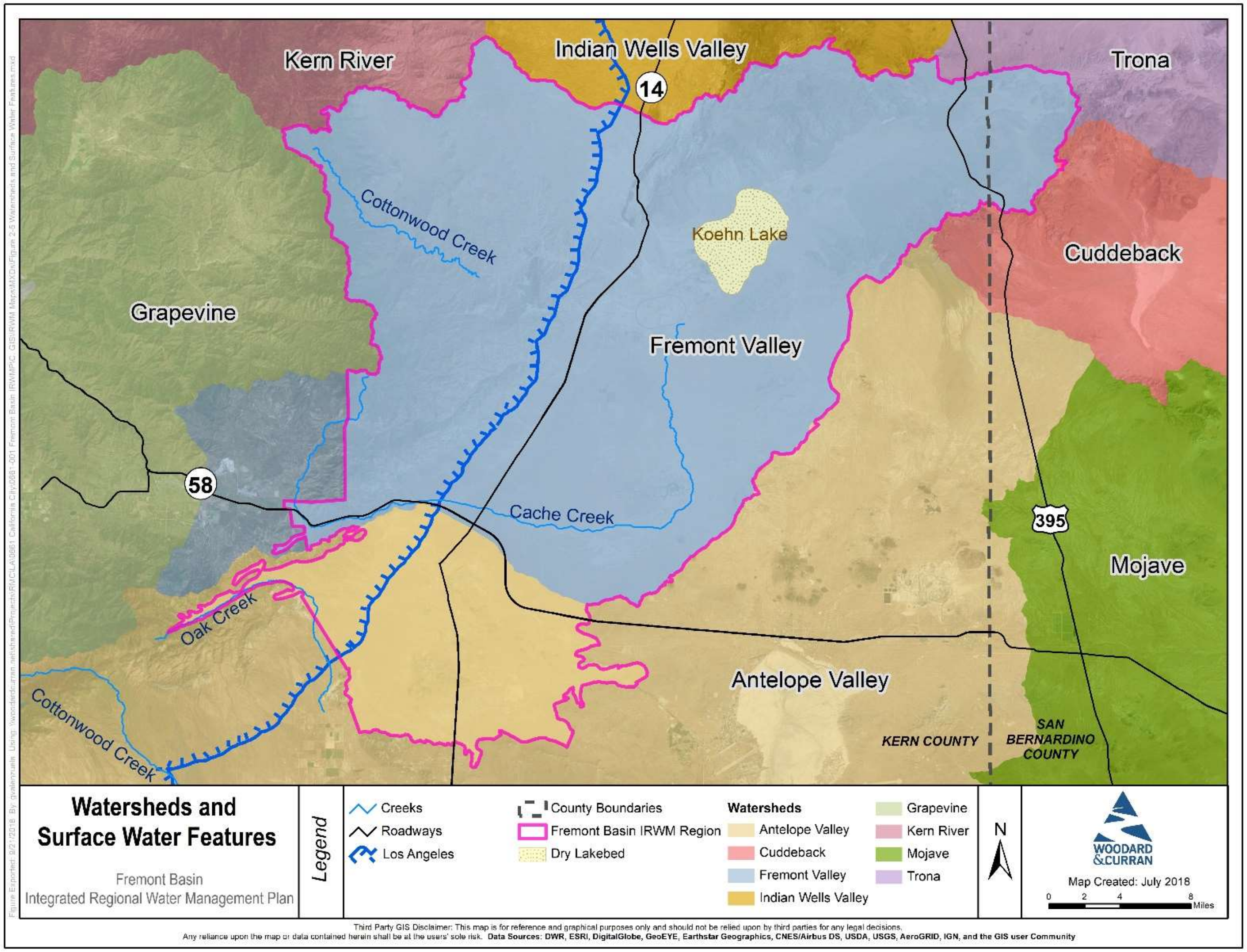
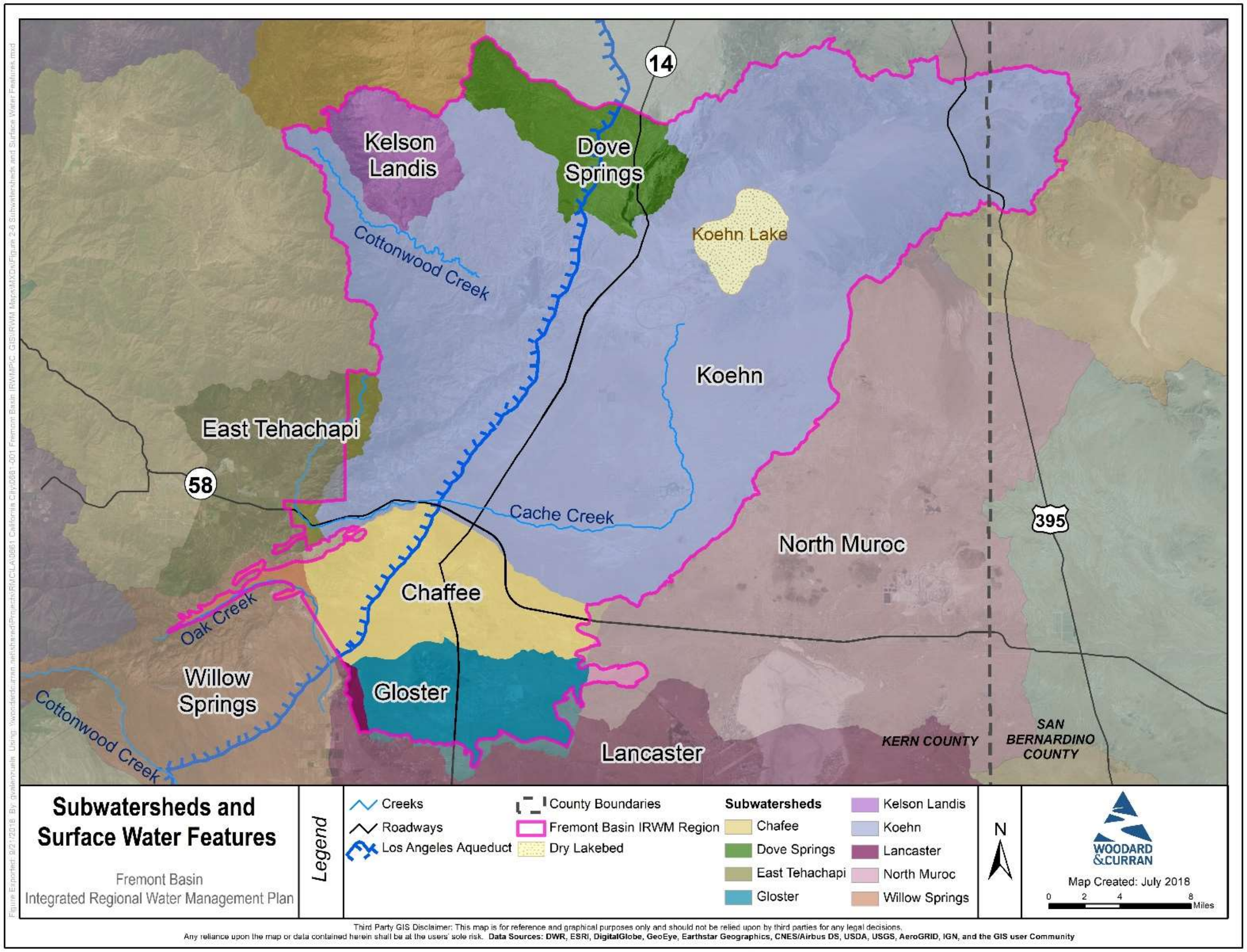


Figure 2-8: Subwatersheds and Surface Water Features



2.2.4 Internal Boundaries

This section discusses the various internal boundaries within the Region, including political jurisdictional boundaries (**Figure 2-9**), water purveyor service boundaries (**Figure 2-10**), wastewater service boundaries (**Figure 2-11**), flood control agencies (**Figure 2-12**), and land use agency boundaries (**Figure 2-13**).

Political Jurisdictional Boundaries

The Fremont Basin IRWM Region lies primarily within Kern County, with a small portion of the Region in western San Bernardino County. The only city within the Region includes is the City of California City. The remainder of the Region is unincorporated Kern and San Bernardino Counties. **Figure 2-9** depicts the county, municipality, and tribal boundaries within the Fremont Basin IRWM Region. The town of Mojave, though part of unincorporated Kern County, is a major township in the Region and, as such, is also identified in the figure. While a boundary for Native American lands held in trust by the U.S. government was identified and is shown in Figure 2-9, there were no federally recognized tribes identified in the Region.

Water Purveyor Service Areas

There are six public water agencies that supply water within the Fremont Basin IRWM Region. These include the City of California City, MPUD, AVEK, California Water Service Company (Cal Water), RCWD, and Rancho Seco Inc. AVEK is the Region's wholesaler, whose sphere of influence extends into the Region, and whose customers include California City and MPUD. California City serves the City of California City. MPUD's service area is entirely within the Fremont Basin IRWM Region, in the southern portion of the Region. Cal Water has a small district north of California City. RCWD covers the northeast portion of the Region, and Rancho Seco Inc. serves a small portion of the Region in the Cantil area. The Tehachapi-Cummings County Water District (TCCWD) is another wholesaler that has a small portion of their service area in the western edge of the Region, but does not provide supply within that area at this time. Other water systems within the Region include the American Honda Company, Red Rock Canyon Service, and Edwards Airforce Base service area. The boundaries of the public water agencies in the Region are shown in **Figure 2-10**, including the system service boundaries for California City, MPUD, and RCWD within their sphere of influence.

Wastewater Service Areas

Wastewater sewer service in the Region is provided by MPUD and California City. The remainder of the Region is on septic systems. Kern County Public Health Services Department is responsible for regulating onsite-wastewater treatment systems with septic tanks in the unincorporated areas of Kern County outside of municipal sewer service boundaries (Kern County EHS Department 2016). California City owns and operates a wastewater treatment plant (WWTP) and all domestic sewer collection systems within the City boundaries. City sewage is collected into sewage mains and delivered to the WWTP located in the northeast part of the City. Approximately 30 percent of the City is served by the WWTP; the remaining population relies on septic systems (California City Water Department 2017). MPUD also has one WWTP and provides wastewater services to its entire service area with the exception of the Cache Creek portion of its service area. The wastewater service area boundaries and facilities are shown in **Figure 2-11**.

Figure 2-9: Political Jurisdictional Boundaries

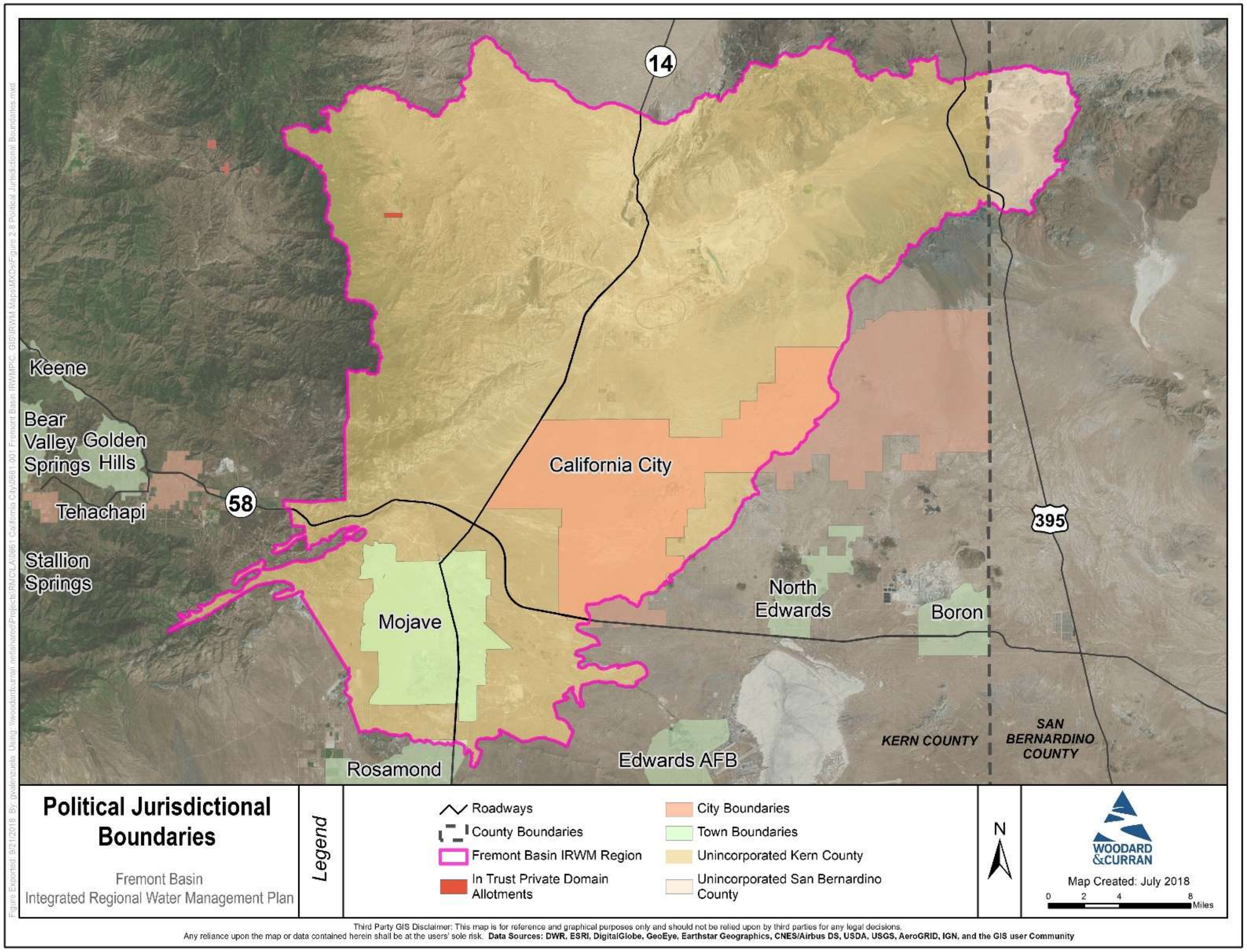


Figure 2-10: Regional Water Service Providers

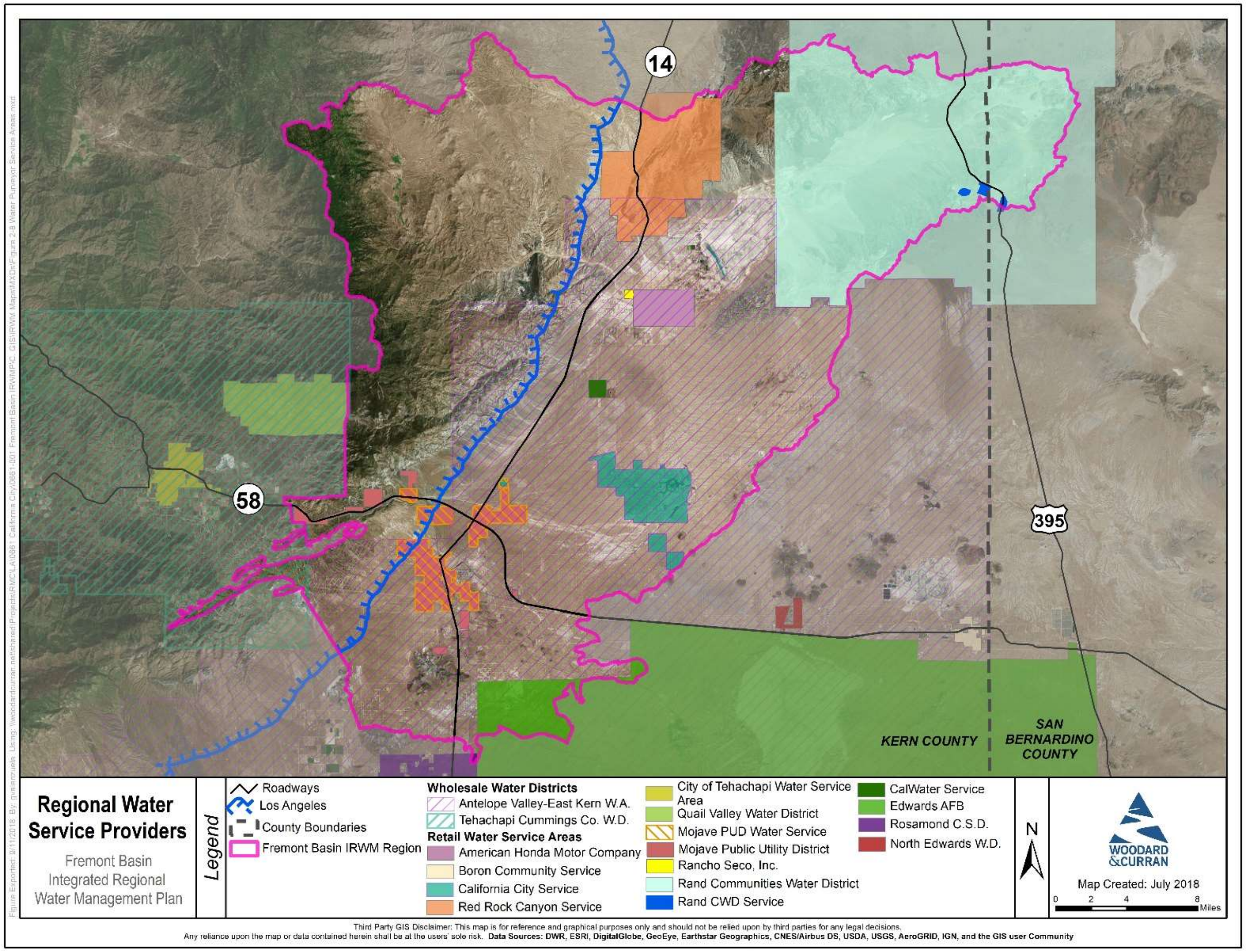


Figure 2-11: Wastewater Service Areas

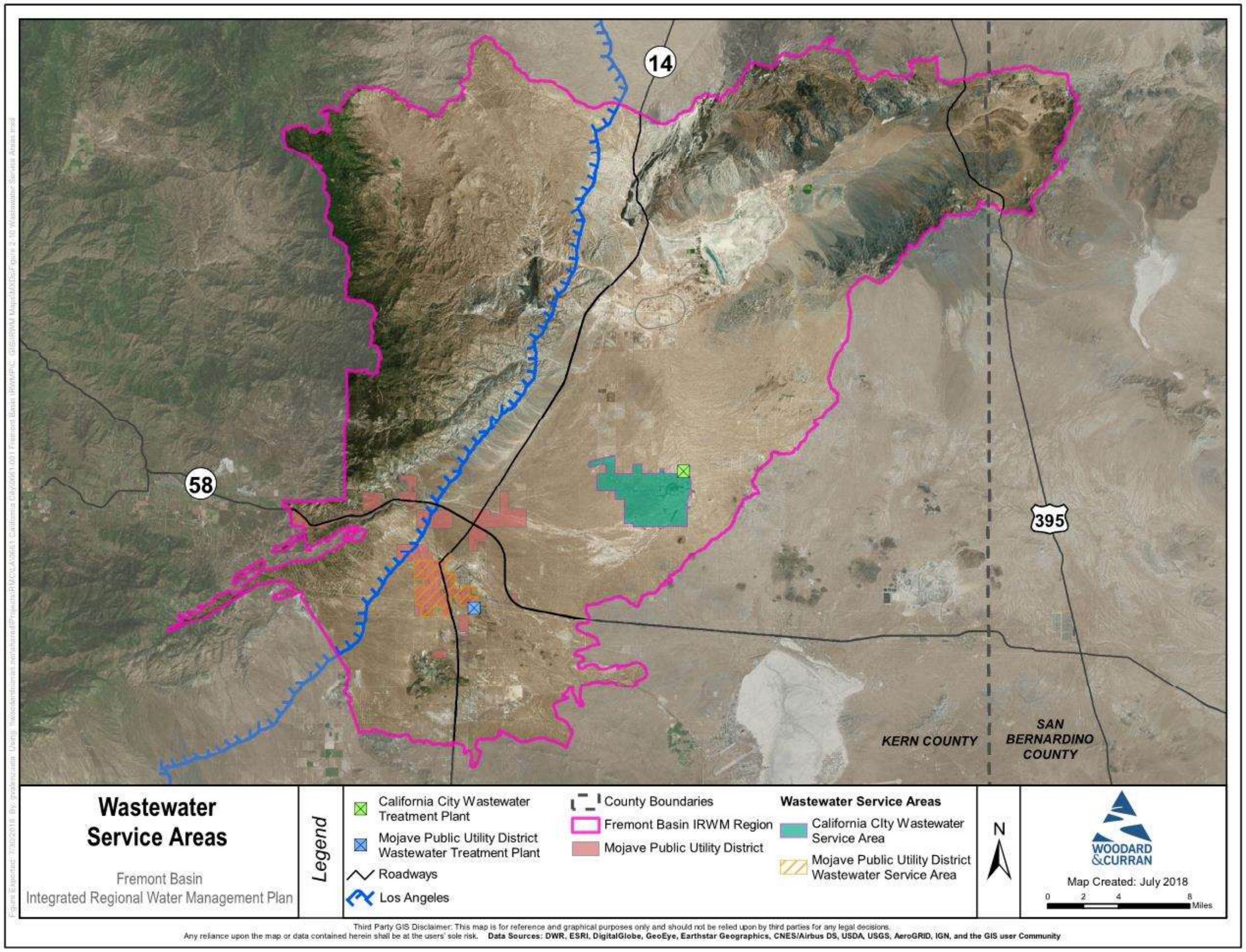


Figure 2-12: Flood Control Agencies

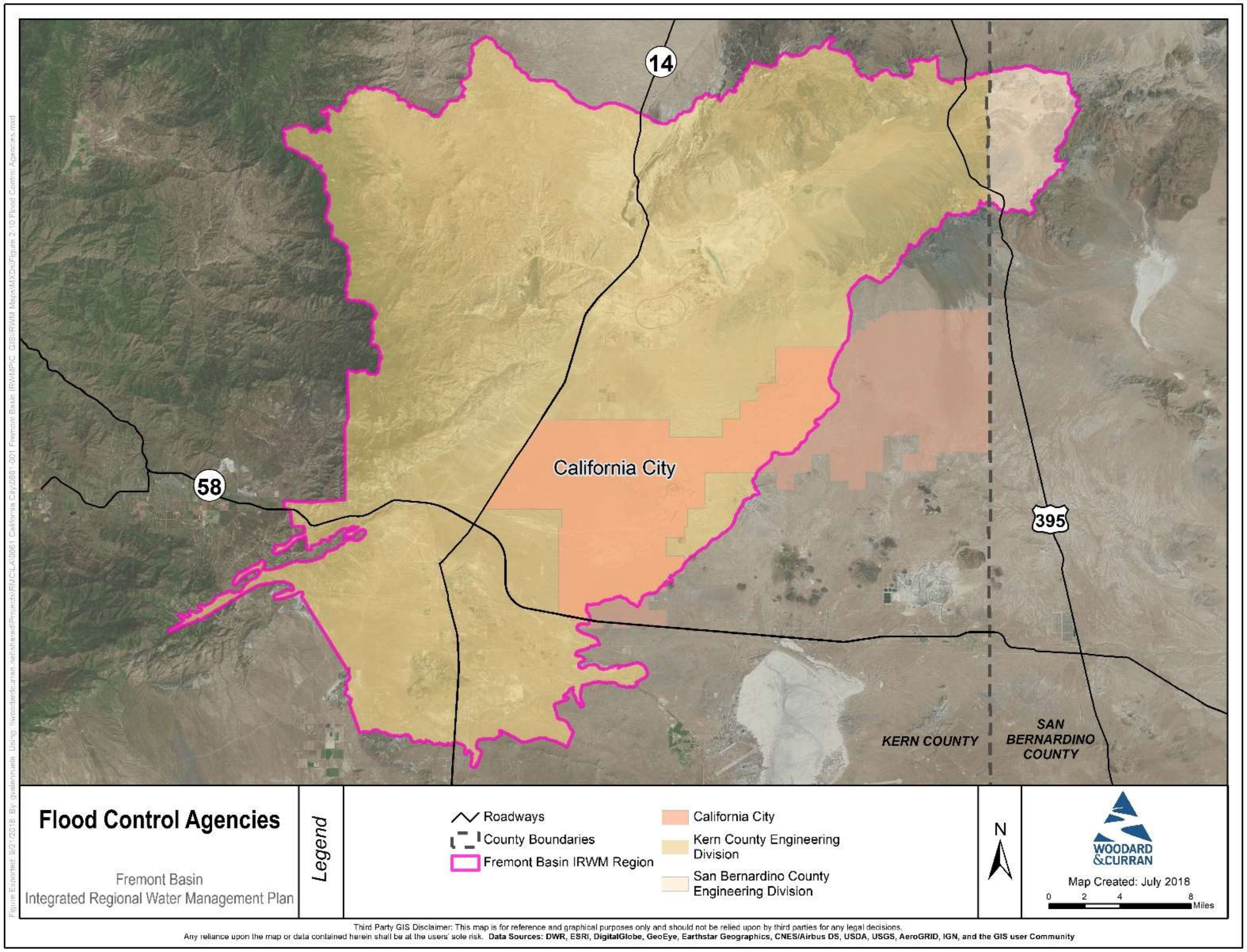
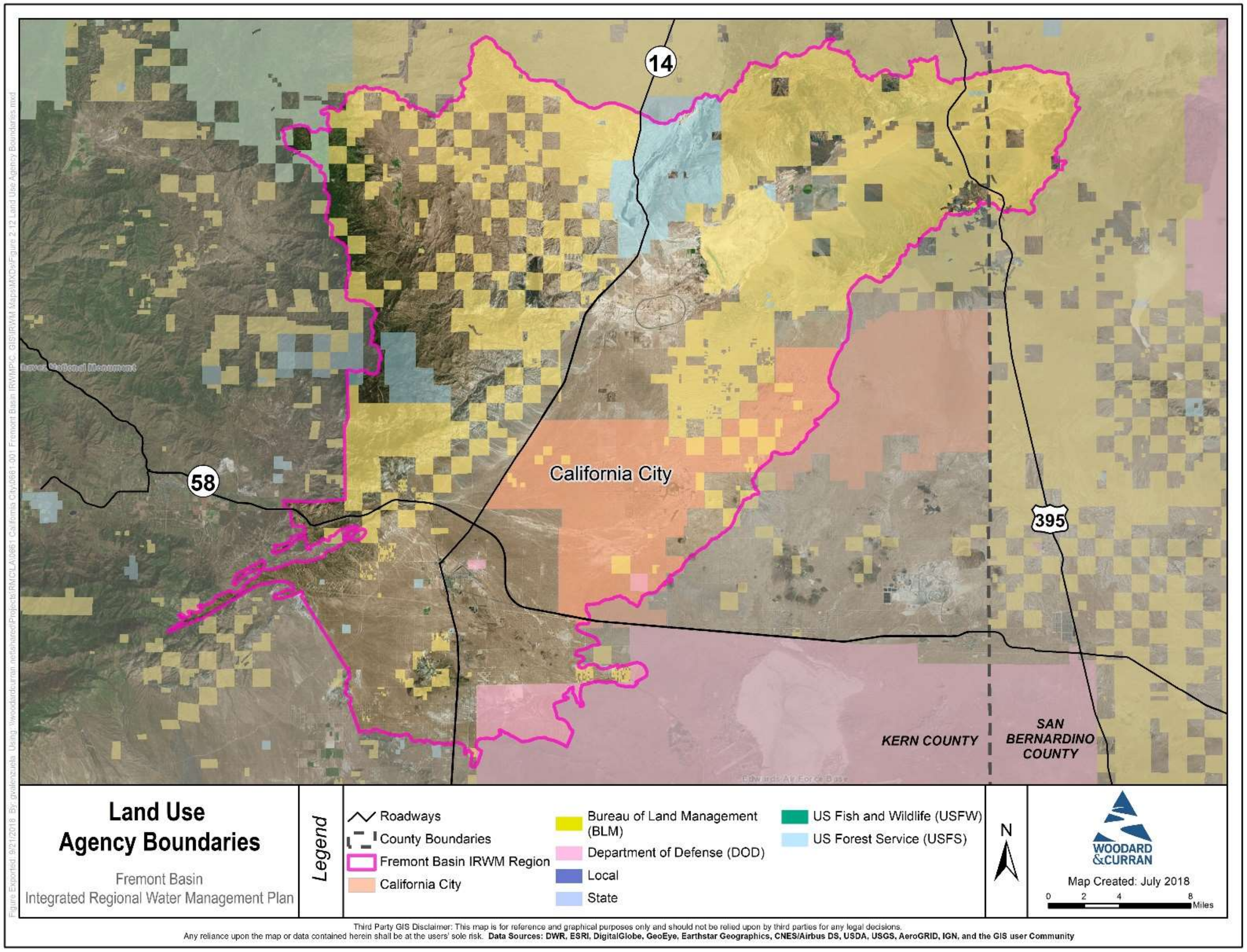


Figure 2-13: Land Use Agency Boundaries



Flood Control Boundaries

Flood control is managed by Kern County, San Bernardino County, and the City of California City, as shown in **Figure 2-12.** There are no flood control districts in the Region. The Kern County Engineering Division provides flood control to all areas prone to flood hazards, flood-related erosion hazards, and mudslide hazards within unincorporated regions of Kern County. They are also responsible for management of potential flood hazards created by new development encroaching on floodplains and imposing flood protection requirements, including hydrologic studies, flood mapping, rainfall and stream gauging, and implementation of the National Flood Insurance Program. Similarly, the San Bernardino County Flood Control Engineering Division prepares plans and implements flood control projects for the portion of the Region that lays in unincorporated San Bernardino County. The City has flood control jurisdiction within the municipality. More information on flood control in the Region is presented in *Section 2.5: Flood Control*.

Land Use Agency Boundaries

Land use policy within the Region is set by the City of California City, Kern County, San Bernardino County, and various state and federal agencies, including the U.S. Forest Service and BLM. The jurisdictions for the major city, State, and federal land use agencies are indicated in **Figure 2-13**. The Kern County and California City General Plans delineate major land uses for residential, commercial, industrial, conservation, government, and development, as discussed in *Section 2.7: Land Use*.

2.3 Sources of Supply and Infrastructure

The Fremont Basin IRWM Region utilizes a combination of water sources to meet regional water demand, including groundwater, imported water, and some recycled water. Supplies are delivered to customers by water agencies, or pumped on-site using private wells. The following sections discuss in detail each supply source used within the Region and the infrastructure required for its use.

2.3.1 Water Agencies

There are six retail water purveyors and one wholesale water agency that supply water in the Fremont Basin IRWM Region. These agencies include AVEK, MPUD, California City, Rancho Seco Inc., RCWD, and Cal Water. In addition to these purveyors, there are two water systems, Honda Proving Center and Red Rock Canyon, that supply water from private wells within their property. TCCWD is also a wholesaler that has a small portion of their service area in the Region but does not supply water to the Region. Each of these agencies and systems are described below.

Antelope Valley-East Kern Water Agency

AVEK is a wholesale water supplier that started delivering surface water to the Region in 1980. AVEK serves roughly 2,400 square miles in the western part of the Mojave Desert, serving Los Angeles, Ventura, and Kern Counties. AVEK's area of influence covers the southeastern portion of the Region, as shown in **Figure 2-10**. AVEK utilizes two water sources: imported water from the SWP and groundwater from wells located within the Antelope Valley Groundwater Basin. To maximize use of its SWP supplies, AVEK developed four exchange programs with agencies outside the Region and intends to develop more such programs in the future. Additionally, AVEK developed groundwater banking programs to increase imported water storage and supply reliability in the Antelope Valley

Region. These programs are critical for AVEK since they do not have direct control over any surface water supplies, nor do they beneficially use stormwater or distribute recycled water (AVEK 2016).

Mojave Public Utility District

MPUD has been distributing water since it was chartered in 1938 and currently serves roughly 19 square miles of unincorporated residential, commercial, industrial, and undeveloped land in the southeastern portion of Kern County at the western edge of the Mojave Desert. MPUD serves approximately 4,200 customers, entirely within the Region, with groundwater supplies located northeast, southwest, and northwest of the town of Mojave. MPUD also began purchasing some imported water from AVEK in 1979 (AVEK 2016).

City of California City

As the only water supplier to the City of California City, the California City Water Department currently serves approximately 4,411 connections in the southeastern portion of Kern County within the City. Almost all of the City's distribution system population is within the Region. The City uses six primary groundwater wells and intends to add two more wells in 2019. California City supplements its groundwater sources with imported SWP water purchased from AVEK (AVEK 2016). Water supply for the Wonder Acres area portion of the City is delivered through MPUD's system, for which California City pays a wheeling charge. The connection can deliver water to Wonder Acres from AVEK, though is currently only delivering MPUD pumped supply. The Wonder Acres System has been active since 1979 and had 38 service connections as of 2015.

Rancho Seco Inc.

Rancho Seco Inc. is a potable water purveyor in the northern portion of the Region that serves approximately 30 residents in Cantil. Supplies from Rancho Seco Inc. are entirely from groundwater pumped from a single well in the FVGB (SDWIS N.D.d). In 2015, Rancho Seco Inc. served approximately 9 AFY of potable water.

Rand Communities Water District

RCWD is a small community water system that has been active since 1976. RCWD currently serves approximately 400 residents in the communities of Johannesburg, Randsburg, and Red Mountain in the northern portion of the Fremont Basin IRWM Region. Pumped groundwater from the FVGB, supplied by two wells, is the sole water source for RCWD (SDWIS N.D.e; SWRCB 2016).

California Water Service Company

Cal Water, formed in 1926, is a large investor-owned water utility, serving more than 477,900 customers throughout the State. Cal Water's Antelope Valley District was formed in 2000 when it purchased the Antelope Valley Water Company. It serves approximately 1,400 connections in northeastern Los Angeles and southeastern Kern Counties and is comprised of four geographically distinct water systems. One of these, the Fremont Valley system, is located in the Fremont Basin IRWM Region. The Fremont Valley system serves an unincorporated community at the base of the Tehachapi Mountains north of California City. The Fremont Valley system includes two wells that pump from the FVGB, one storage tank, and one booster pump. In 2015, Cal Water served approximately 14 AF to a total of 76 connections in the Fremont Valley system. It is expected that groundwater will continue to be the sole source of water for Cal Water's Fremont Valley system (California Water Service 2016a; California Water Service 2016b).

American Honda Motor Company

American Honda Motor Company has a small water system that distributes pumped groundwater from the FVGB to the Honda Proving Center, an automotive testing center. The Honda Proving Center system is a non-community water system that does not provide water to residential users. The system became active in 2016 and now serves approximately 60 users in an industrial service area. Pumped groundwater, supplied by a single well, is the sole source for the system (SDWIS N.D.b).

Red Rock Canyon

Red Rock Canyon is a California State Park 25 miles northeast of the town of Mojave. The park has its own non-community water system, run by the California Department of Parks and Recreation, that has been active since 1976. It serves up to 400 transient, two non-transient, and six residential users within the recreational service area. Supply for the system is surface water from the Los Angeles Aqueduct treated at a pocket surface water treatment plant (SDWIS N.D.a).

Tehachapi-Cummings County Water District

The TCCWD service area encompasses approximately 266,000 acres in the Tehachapi Mountains west of the Region. TCCWD imports SWP as well as distributes groundwater from the Tehachapi, Brite, and Cummings groundwater basins (TCCWD 2018). Though a small part of the TCCWD service area extends into the western edge of the Region boundary, TCCWD does not supply water to the Region.

2.3.2 Imported Water Supplies

Imported water in the Region comes from Northern California via the SWP. The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants that store and distribute water to 29 urban and agricultural suppliers throughout California, known as "State Water Project Contractors" (DWR N.D.a). Owned and operated by DWR, the SWP helps meet regional water demand in the Fremont Basin IRWM Region in conjunction with local water supplies.

AVEK, the SWP contractor in the Region, signed a contract with DWR in the 1960s for a 75-year term that will expire in 2035, though it is anticipated that the SWP contracts will be extended through 2085. The contract allocates 144,844 AF per year to AVEK from the SWP, the third largest allocation of the 29 SWP contractors. To increase regional supply reliability, AVEK developed groundwater banking programs to store excess water, when available, from the SWP during wet periods, allowing for recovery during dry and high demands periods, or during a disruption in deliveries from the SWP. AVEK's groundwater banking programs include the Westside Water Bank, which started operations in 2010, and includes approximately 400 acres of groundwater recharge basins and 9 groundwater recovery wells. These facilities have a recharge capacity of 36,000 AFY within the Antelope Valley Groundwater Basin, south of the Fremont Basin Region. AVEK's Eastside Water Bank started operations in 2016 and has a recharge capacity of 5,700 AFY. The Eastside Water Bank facilities include three 2-acre recharge basins and three groundwater wells that allow the recharge and recovery of raw imported water into the Antelope Valley Groundwater Basin. While these projects lie outside the Region, the increase in supply reliability provides benefits to AVEK's entire service area, including those customers within the Fremont Basin IRWM Region. Additional groundwater banks are planned by AVEK.

Within the Fremont Basin IRWM Region, AVEK delivers imported water to MPUD and California City. According to AVEK's imported water record, historical imported water deliveries to the City have averaged 669 AFY since 1980, and to MPUD averaged 208 AFY since 1979. **Table 2-2** shows the volume of imported water delivered to these agencies through AVEK in 2015. Based on historical SWP deliveries to AVEK, as summarized in **Table 2-3**, it is projected that only 59 percent[2] of the allotted 144,844 AF (85,500 AFY) will be delivered to AVEK in an average year. However, in 2014, supply allocations were as low as 8 percent due to the statewide drought (AVEK 2016). Current and projected deliveries of imported water are summarized in **Table 2-4**.

Table 2-2: AVEK Deliveries to Water Agencies in the Fremont Basin IRWM Region

Receiving Agency	Level of Treatment	2015 Volume (AF)
MPUD	Drinking Water	2
City of California City	Drinking Water	651

Source: AVEK 2016.

Table 2-3: Historical SWP Deliveries to AVEK

	1960	1970	1980	1990	2000	2010	2014
SWP Deliveries to AVEK (AF)	71,000	102,000	141,000	17,000	101,000	56,563	14,510

Sources: 1960-2010 data from AVEK 2016; 2014 data from California Natural Resources Agency 2015.

Table 2-4: Actual and Projected Imported SWP Deliveries to AVEK

	2015	2020	2025	2030	2035
SWP Deliveries to AVEK (AF)	29,938	89,803	89,803	89,803	89,803

Source: AVEK 2016.
Note: Values in this table are for assumed average water years.

2.3.3 Groundwater

Most of the Fremont Basin IRWM Region's water supply comes from groundwater. The Region overlays the entirety of the Fremont Valley and Kelso Lander Valley Groundwater Basins, and portions of six other groundwater basins, including the Indian Wells Valley, Harper Valley, Tehachapi Valley East, Cuddeback Valley, Antelope Valley, and Searles Valley groundwater basins. The groundwater basin boundaries are shown in **Figure 2-14** and discussed in further detail in the sections below. A summary of the groundwater basins in the Fremont Basin IRWM Region is provided in **Table 2-5**.

[2] The projected SWP water supply of 59 percent is based on the results of the DWR's 2015 Delivery Capability Report Early Long-Term scenario (California Natural Resources Agency 2015). This is lower than the 62 percent reported in the 2015 SWP Delivery Capability Report because the SWP Delivery Capacity Report estimates are an average of 1921-2003 deliveries and do not include the dry hydrologic conditions that led to the low 2014 SWP water supply allocation.

Figure 2-14: Groundwater Basin Boundaries

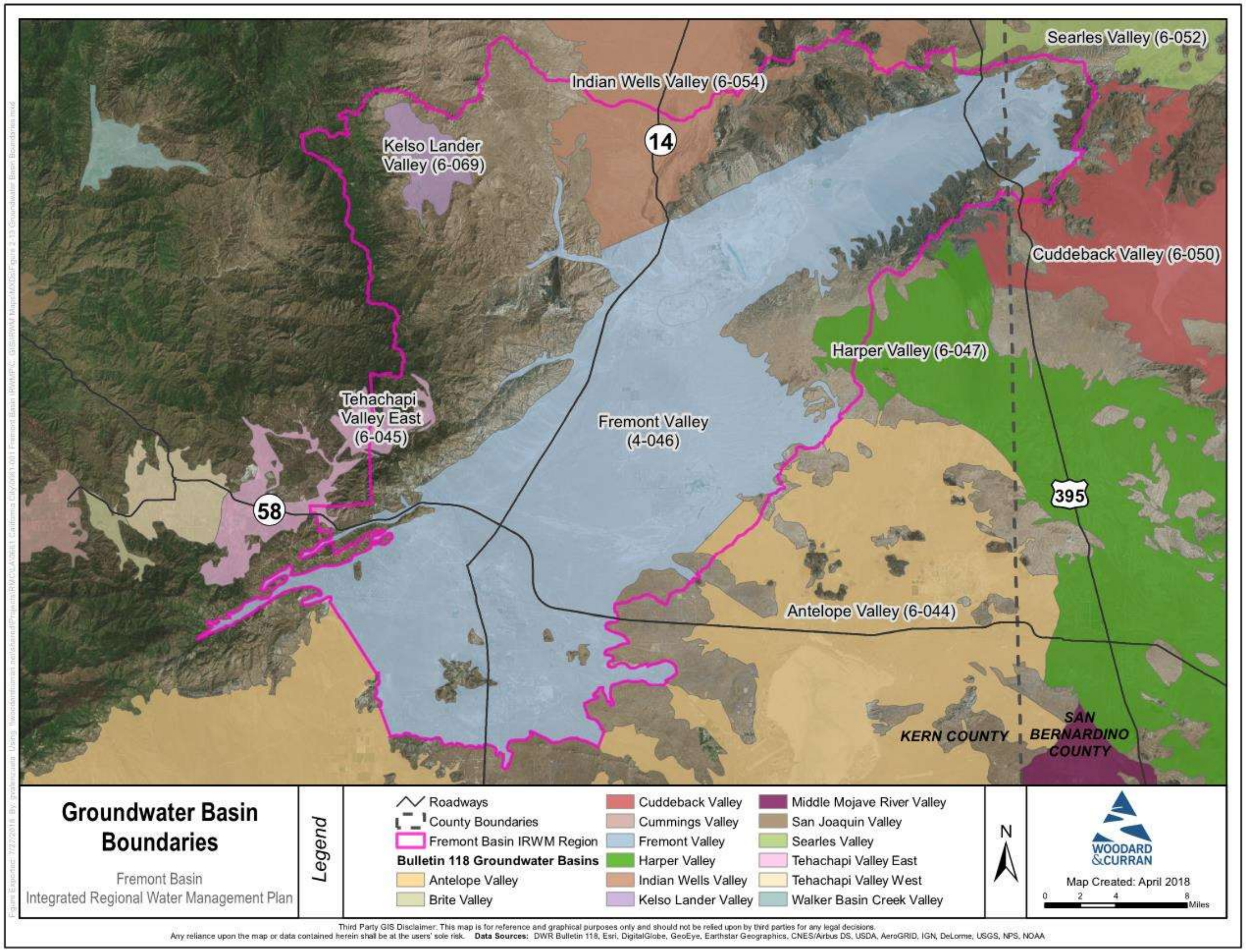


Table 2-5: Summary of Fremont Basin IRWM Region Groundwater Basins

	Fremont Valley	Indian Wells Valley	Kelso Lander Valley	Harper Valley	Tehachapi Valley East	Cuddeback Valley	Antelope Valley	Searles Valley
Total Surface Acres[1]	336,682	383,492	11,208	411,827	24,055	95,418	1,014,596	198,115
Percent Acres Underlying Region[2]	100%	9%	100%	1%	21%	1%	0.3%	0.1%
Recharge Sources[3]	Percolation of ephemeral streams that flow from the Sierra Nevada	Percolation along southwest, west, north, and northeast edges	Percolation of runoff, infiltration of rainfall, and subsurface inflow	Percolation of runoff, infiltration of rainfall and subsurface inflow	Percolation from streamflow and infiltration of rainfall	Percolation of runoff, infiltration of rainfall and subsurface inflow	Percolation of perennial runoff, recycled water groundwater recharge	Percolation of runoff and subsurface inflow
Storage Capacity (AF)[3]	4,800,000	5,120,000	Unknown	6,975,000	150,000	1,380,000	70,000,000	2,140,000
Groundwater Stored (AF)[3]	Unknown	2,050,000	Unknown	101,500	Unknown	Unknown	Unknown	Unknown
Direction of Drainage[3]	North toward Koehn Lake	Northeast toward China Lake playa	South toward Jawbone Canyon	South toward Harper Lake	Split at drainage divide, moves east and west	Toward Cuddeback Lake in the central part of the basin	North from San Gabriel Mountains, south and east towards Rosamond, Rogers, and Buckhorn Lakes	Towards central part of the basin
Wells within the Region[4]	Private and public	Private	Private	None	Private and public[5]	None	None	None

	Fremont Valley	Indian Wells Valley	Kelso Lander Valley	Harper Valley	Tehachapi Valley East	Cuddeback Valley	Antelope Valley	Searles Valley
Adjudicated?	No	No	No	No	Yes	No	Yes	No
CASGEM Priority	Low	High	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
SGMA Status	Not required to comply	GSA: Indian Wells Valley Groundwater Authority	Not required to comply	Not required to comply	Not required to comply	Not required to comply	Not required to comply. GSAs: 1) Leona Valley, and 2) East Acton Groundwater Sustainability Agency	Not required to comply

Notes: (1) DWR 2014b; (2) Calculated using geographic information systems (GIS) using DWR Bulletin 118 boundary layer; (3) DWR 2004a-h;(4) Kern County GIS well database; (5) MPUD has 2 observation wells in the basin

Groundwater Management

Because the Region relies heavily on groundwater as a source of supply, proper management of this resource is critical to the Region's long-term water supply sustainability. Recognizing this, Kern County approved a Zoning Ordinance Section 19.118 in 1998 that prohibits the extraction and transportation of groundwater sources to areas outside the Fremont Valley Watershed and Kern County without a Conditional Use Permit. The ordinance applies to all native groundwater supplies in the Region, and excludes both artificially recharged groundwater and groundwater that originates outside the County (Kern County 1998).

On November 4, 2009, the State Legislature amended the Water Code with SBx7-6, which mandates a statewide groundwater elevation monitoring program to track seasonal and long-term trends in groundwater elevations in California's groundwater basins. In accordance with this amendment to the Water Code, DWR developed the California Statewide Groundwater Elevation Monitoring (CASGEM) program. The intent of the CASGEM program is to establish a permanent, locally-managed program of regular and systematic monitoring in all of California's alluvial groundwater basins. The CASGEM Groundwater Basin Prioritization process, implemented as part of the CASGEM program, is a statewide ranking of groundwater basin importance that incorporates groundwater reliance and focuses on basins producing greater than 90 percent of California's annual groundwater. The California Water Code (CWC) specifies the eight criteria to be used for prioritizing the basins. Criteria include overlying population, projected growth, public supply wells, total number of wells, reliance on groundwater as primary source and impacts on groundwater (i.e., overdraft, subsidence, etc.)

In 2014, the Water Code was amended again as a result of SGMA. SGMA requires groundwater-dependent regions to halt overdraft and bring basins into balanced levels of pumping and recharge by developing a basin-specific GSP. Using the CASGEM basin prioritization list finalized in May 2018, DWR determined which basins would be required to comply with SGMA. As a result of this prioritization, the Indian Wells Valley is the only basin in the Region that is required to comply. To comply, the basin's pumpers must organize to form at least one GSA and submit to DWR a SGMA-compliant GSP by January 31, 2020. SGMA applies to a total of 109 high and medium priority groundwater basins in California. Basins classified as low or very low priority, such as the FVGB, are not the focus of SGMA at this time, yet participation in SGMA through formation of a GSA and preparation of a GSP is still considered valuable in the Region as it provides local sustainable management of groundwater supplies.

Fremont Valley Groundwater Basin

Used as the primary groundwater supply source in the Fremont Basin IRWM Region, the FVGB underlies approximately 336,700 acres entirely within the Region from eastern Kern County to the northwestern region of San Bernardino County (DWR 2014b). The FVGB spans the largest area in the Region, covering approximately 53 percent of the Region's area; the basin extends from the northeastern boundary to the southwestern boundary of the IRWM Region. The Fremont Basin is bounded on the northwest by the El Paso Mountains and the Sierra Nevada Mountains and on the east by the Summit Range, Red Mountain, Lava Mountains, Rand Mountains, Castle Butte, Bissel Hills, and Rosamond Hills. The basin is bounded on the southwest by the Antelope Valley Groundwater Basin along a groundwater divide approximated by a line connecting the mouth of Oak Creek through Middle Butte to exposed basement rock near Gem Hill.

The FVGB is recharged from two sources: precipitation to the valley floor and percolation of runoff from mountains and neighboring watersheds. As the runoff migrates over the valley floor, losses occur by evaporation and transpiration. Infrequent, intense runoff reaches as far as Koehn Lake, in the northeastern part of the FVGB or the other small playas throughout the basin. Because the lake bed is nearly impermeable, most of the water is ponded and lost to evaporation (USGS 1977). Recharge to the FVGB also occurs from underflow in the creek channels that emanate from the mountains. There is no appreciable quantity of groundwater flowing out of the basin and surface drainage of the basin is of the closed type. An analysis conducted for the Fremont Valley Basin GWMP estimated natural recharge to the FVGB at approximately 13,800 AFY[3] on average (Woodard & Curran 2018a).

Surface runoff within the Fremont Valley Watershed either recharges to the basin or drains toward Koehn Lake. The groundwater flow follows a similar path to surface runoff, with water in the southwestern portion flowing north towards the City of Mojave and then Koehn Lake; the rest of the basin flows directly toward Koehn Lake. Groundwater is generally unconfined except for near Koehn Lake.

Different estimates of groundwater storage are reported for the FVGB or portions of the basin. DWR reports a storage capacity of 4.8 million acre-feet (MAF), though the amount of groundwater in storage is currently unknown. Groundwater storage was reported to be 4.1 MAF in 1976 based on a USGS study (USGS 1977). A more recent investigation by Stetson (2009) estimated the groundwater storage for two portions of the groundwater basin identified in the study, the Mojave City and California City Subbasins, at approximately 5.66 MAF and 2.62 MAF, respectively. Groundwater storage under Koehn Lake, above the 500 feet depth, was estimated to be approximately 2 MAF (USGS 1977).

Long-term groundwater level data indicate that the groundwater levels in the FVGB have declined significantly since 1955, probably due to the prolonged drought period from 1945 to 1964 and increased groundwater extractions in the late 1950s through the 1970s.

In the southern portion of the FVGB, south of the Muroc fault, groundwater levels were the highest in the late 1950s, prior to the start of pumping by MPUD in 1960. Groundwater levels declined gradually until approximately 1968, when water levels began to decline at a greater rate. This coincides with increases in MPUD production. Around 1980, water levels continued to decline but at a much lower rate, which coincides with decreased pumping by MPUD when AVEK imported water deliveries became available in 1980. Groundwater levels increased in this area after 1974, possibly due to a reduction in irrigation pumping in the area.

Groundwater levels in the northern portion of the FVGB, north of the Muroc fault, have declined since the late 1960s, and trends have varied more drastically compared to the southern portion of the FVGB. Similar to the southern portion of the FVGB, there is an apparent trend of rising groundwater

[3] This recharge estimate is higher than the 1977 USGS recharge estimate which noted a local groundwater recharge of 10,200 AFY. The difference in the recharge estimates is primarily due to the different basin footprint used in the USGS analysis.

levels after AVEK deliveries began in 1980. Additionally, there has been some recovery of groundwater levels in the northern portion of the FVGB following the reduction of heavy irrigation pumping that occurred through the 1970's. Groundwater levels and natural recharge to the FVGB are discussed in depth in the Fremont Valley Basin GWMP included as Appendix B.

The FVGB is identified as a low priority basin through the CASGEM program and is not the focus of SGMA at this time. Despite this, efforts to provide sustainable groundwater management for the FVGB are being explored by stakeholders in the Region. The Fremont Valley Basin GWMP (Appendix B) was developed as a precursor to development of a GSP for the FVGB as part of the 2019 IRWM planning process.

Indian Wells Valley Groundwater Basin

The groundwater basin that underlies the second largest area within the Region is the Indian Wells Valley Groundwater Basin, a critically over-drafted, CASGEM high-priority basin that spans 383,500 acres in the Inyo, Kern, and San Bernardino counties (DWR 2014b). Roughly 33,000 acres of the basin are within the northern part of the Region, though this is only 9 percent of the groundwater basin's total surface area. The Indian Wells Valley Basin is closed and bounded by the Sierra Nevada Range on the west, the Coso Range on the north, the Argus Range on the east, and the El Paso Mountains on the south. China Lake is the major surface water feature located at the center of the basin. The basin consists of an upper aquifer and a lower aquifer that serves as the primary producer of groundwater supplies. Groundwater extractions and recharge programs using recycled water outside of the Region have altered the natural flow of the basin (Warner 1975).

The Indian Wells Valley Basin has a groundwater storage capacity of approximately 5.12 MAF, though some studies have calculated storage capacity as low as 2.2 MAF (DWR 2014b). Between 1921 and 1985, groundwater levels decreased by 150,000 AF (DWR 2004e) due to overpumping. As a result of the CASGEM prioritization process, the Indian Wells Valley Groundwater Basin received a high-priority designation.

To combat overdraft, a Groundwater Management Plan was developed in 2006 to implement sustainable management practices for groundwater extractions (DWR 2006). Plan objectives include:

- Limiting large scale pumping in the area
- Distributing groundwater extractions so that adverse impacts are not localized
- Developing and implementing water conservation and education programs
- Encouraging recycled water use
- Exploring additional sustainable water management practices
- Continuing technical studies to better inform groundwater management
- Developing an interagency management framework to implement the Plan

Kelso Lander Valley Groundwater Basin

The Kelso Lander Valley Groundwater Basin, a CASGEM very low-priority basin, underlies 11,200 acres and lies entirely within the Region (DWR 2014b). The basin is located in the northwestern portion of the Region and is bounded by the Sierra Nevada Mountains. Some private wells exist in the basin as reported by Kern County and USGS. Surface water in the Kelso Lander Valley flows to the Fremont Valley watershed from the Cottonwood Creek and through Jawbone Canyon. The current storage capacity, total groundwater stored, and groundwater level trends in the basin are unknown. Recharge occurs from runoff percolation in the alluvial fans, rainfall infiltration in the Kelso Lander Valley, and subsurface inflow. Similar to surface water movement, groundwater flows toward Jawbone Canyon (DWR 2004f).

Harper Valley Groundwater Basin

The Harper Valley Groundwater Basin, a CASGEM very low-priority basin, underlies 411,800 acres in the western San Bernardino and eastern Kern Counties (DWR 2014b). Approximately 5,000 acres of the basin lie on the eastern boundary of the Region. The basin is bounded on the north, east, and south by mountains and hills and on the west by a series of faults and hills. Seasonal streams in the Harper Valley drain toward Harper Lake, outside the Region. The groundwater is generally unconfined, except for near Harper Lake. The basin has a storage capacity of approximately 6.9 MAF, though groundwater storage in 1990 was estimated at 101,500 AF. Natural recharge occurs from percolation of rainfall and surface runoff in the alluvial fans around the valley as well as from flow from the Middle Mojave River Valley and Cuddeback Valley Groundwater Basins. Pumping from Harper Valley Groundwater Basin does not occur within the Region.

Tehachapi Valley East Groundwater Basin

The Tehachapi Valley East Groundwater Basin, a CASGEM very low-priority basin, underlies approximately 24,100 acres within Kern County, 5,000 of which lie in the northwestern part of the Region (DWR 2014b). The Sierra Nevada Mountains bound the northern portion of the basin, the Tehachapi Mountains bound the southern and eastern portions, and an alluvial high (surface drainage divide) bounds the western side. The alluvial high causes surface waters to the west of the boundary to flow to Tehachapi Creek and surface waters to the east of the boundary to flow to either Proctor Dry Lake or Cache Creek. The majority of wells that pump from the basin are located outside the Region, though there are a few private wells in the Region, as reported by Kern County and USGS.

The Tehachapi Valley East Groundwater Basin has a total storage capacity of approximately 150,000 AF, though the total groundwater stored has yet to be determined. Groundwater storage decreased by approximately 41,500 AF between 1951 and 1978. To mitigate these losses, imported SWP water was used both for supplementing groundwater supplies and for supplying groundwater recharge programs in 1973. Groundwater levels have rebounded since the basin's adjudication in the 1970's, effectively restoring 70,000 AF of groundwater to the basin. The natural recharge of the basin is estimated at approximately 3,000 AF from the percolation of streamflow (DWR 2004h).

Cuddeback Valley Groundwater Basin

The Cuddeback Valley Groundwater Basin, a CASGEM very low-priority basin, underlies 95,400 acres predominantly in the San Bernardino County (DWR 2014b). Only about 835 acres, or 1 percent of the basin's surface area, lie within the northeastern boundary of the Region. The basin is bounded by mountains to the north and west and by hills to the south and east. Surface waters in the Cuddeback Valley drain toward Cuddeback Lake, outside the Region. The basin is naturally recharged with stormwater runoff that percolates through the alluvial fans overlying the basin. Rainfall and subsurface inflow also recharge groundwater supplies. Groundwater in the Cuddeback Valley Groundwater Basin flows towards the Harper Valley Groundwater Basin, and may flow into Harper

Valley Groundwater Basin through an alluvial-filled gap between Fremont Peak and the Gravel Hills (DWR 2004b).

The Cuddeback Valley Groundwater Basin has a storage capacity of 1.380 MAF, yet the current stored volume is unknown. From 1917 and 1970, groundwater levels on the western region of the basin were between 150 and 230 feet below the surface (DWR 2004b).

Antelope Valley Groundwater Basin

CASGEM originally designated the Antelope Valley Groundwater Basin as a high-priority basin in 2014, but the basin was reclassified in 2018. As a result of the basin's recent adjudication, the Antelope Valley Groundwater Basin was changed to a very-low priority basin. The basin covers roughly 1.01 million acres in the Los Angeles, Kern, and San Bernardino counties (DWR 2014b). Of the total basin area, only about 3,100 acres, or 0.3 percent of the basin, lie in the southeastern portion of the Region.

The groundwater basin is bounded by the San Gabriel Mountains on the northwest and the Tehachapi Mountains on the southwest. Runoff from these mountains flows towards a closed basin at Rosamond Lake, located on the Edwards Air Force Base outside of the Region. Groundwater is recharged by perennial runoff from the mountains and hills, return of irrigation water, and septic system effluent. There is a small but significant amount of recycled water irrigation that occurs in the Antelope Valley Groundwater Basin; and there are plans underway to build and operate groundwater recharge projects using imported water, stormwater, and recycled water. AVEK operates groundwater banking projects in the Basin as well. Groundwater flow is constrained by the Garlock, San Andreas, Randsburg-Mojave, Cottonwood, and Willow Springs faults, along with several other fault zones in the area.

The basin has a confined lower aquifer and an unconfined upper aquifer. Permeability between these two aquifers is limited due to clays deposited during periods of heavy precipitation. The upper aquifer is the primary source of groundwater for the Antelope Valley. The Antelope Valley Groundwater Basin can store approximately 70 MAF, though storage capacity has permanently decreased by approximately 50,000 AF in the past couple of decades due to subsidence caused by severe groundwater overdraft. By 1992, groundwater pumping had caused 292 square miles of the Antelope Valley to subside more than one foot (DWR 2004a).

Between 1999 and 2000, two private groundwater users filed a lawsuit against nine public water agencies for unregulated groundwater pumping in the Antelope Valley Groundwater Basin. These lawsuits marked the start of the adjudication of all groundwater rights in the Basin. In 2011, the Basin was determined to be in a state of overdraft with a safe yield of 110,000 AFY. As a result of this lawsuit and subsequent technical work, the Basin was adjudicated in 2015 (Los Angeles County Superior Court 2014).

Searles Valley Groundwater Basin

The Searles Valley Groundwater Basin, a CASGEM very-low priority basin, is the smallest of the seven basins located in the Region; of the basin's 198,100 acres, only about 290 acres or 0.1 percent of the basin, fall within the northeastern border of the Region (DWR 2014b). The basin is bounded by the Argus Range and Spanger Hills on the western side adjacent to the Region. Surface waters in the basin drain to Searles Lake, outside the region. Groundwater movement is restricted by the Garlock fault. The Searles Valley Groundwater Basin has a groundwater storage capacity of approximately 2.14

MAF, though the current volume of groundwater stored is unknown. Recharge occurs from runoff percolation in the alluvial fans in the northern stretch of the Basin and inflow from the Salt Wells and Pilot Knob Valleys (DWR 2004g).

2.3.4 Surface Water

Imported water purchased from the SWP is the only surface water used to meet regional demands. Local surface waters are not reliable sources because most are ephemeral streams that are extremely limited by drought conditions. Much of the surface water in the Region percolates into the various groundwater basins. Additionally, high desert conditions cause water that does not percolate into the groundwater basin to evaporate (AVEK 2016; California City Water Department 2017).

2.3.5 Wastewater and Recycled Water

There are two WWTPs in the Region, owned and operated by MPUD and California City. The WWTP in California City is the only source of recycled water in the Region. The following sections provide more detail on the wastewater treatment facilities and information on recycled water production.

Wastewater

Wastewater service in the Region is provided by California City and MPUD. The remainder of the Region is on septic systems. California City is divided into two sections – the “First Community” and the “Second Community.” Most of the California City residents live in the First Community, which includes multi-family and smaller single-family residential lots. Portions of the First Community are served by the City’s sewer system. The Second Community, which is located east of the center of the City, includes sparsely populated lots served by septic tanks with subsurface disposal. The collection system in the First Community is gravity fed and only transports domestic wastewater, not stormwater runoff. The WWTP is owned and operated by the City, and the California City Sanitary Division is responsible for maintenance of the sewer system.

The primary treatment process at the California City WWTP includes an influent pump station, head works consisting of a Parshall flume, mechanical bar screen and sonic flow meter. Secondary treatment consists of one extended aeration activated sludge basin, (split into two cells) two clarifiers and a return activated sludge (RAS) waste activated sludge (WAS) pump station. The tertiary treatment facilities consist of filter influent pump station, a chemical mixing/flocculation tank, storage facilities for polymer, alum and chlorine, tertiary sand filters and sodium hypochlorite disinfection. In 2002, the capacity of the WWTP was expanded from 1 million gallons per day (MGD) to 1.5 MGD to accommodate population growth. Currently, the plant can treat an average flow of 1.5 MGD and a peak flow of 3.0 MGD, though the average influent is currently 0.8 MGD. Sludge is dewatered, dried, and disposed of at a landfill. There are plans to expand the sewer system through neighborhood sewer assessment districts (California City Water Department 2017), and plans are underway to provide service to the nearby California City Correctional Center.


MPUD’s wastewater percolation ponds

MPUD provides wastewater services to communities west of California City. Between 2012 and 2016, the average annual wastewater inflow to the plant was

121.9 million gallons (MG) and average annual effluent discharge to the percolation ponds was approximately 33.8 MG. Most of the treated effluent remains on-site to evaporate from several evaporation ponds. Any solids remaining are sent to a specialized treatment facility off-site.

Residents in unincorporated areas of the Fremont Basin IRWM Region rely on septic systems that are regulated by the Kern County Public Health Services Department (EHS). These are almost exclusively for properties outside of municipal sewer service boundaries (Kern County EHS Department 2016).

Recycled Water

California City's WWTP, as indicated above, is capable of producing secondary and tertiary treated recycled water. Currently, the only permitted sites for use of the secondary and tertiary treated effluent are the City's eight existing percolation ponds, the Central Park Lake (used as recreational non-contact water) and the Tierra Del Sol Golf Course (used for landscape and course irrigation). The Central Park Lake is primarily a holding transfer point of tertiary treated effluent for the irrigation systems at Tierra Del Sol Golf Course.

On average, the City collects approximately 19 percent of total potable water production or 675 AF; 75 percent of this water, or 500 AF, is recycled and used for irrigation at the Tierra Del Sol Golf Course. When storage basins are full during the winter season, approximately 10 AF, or 1 percent of the recycled water produced, is diverted to percolation ponds to offset groundwater extractions. Expansion of the sewer system in the future will increase recycled water availability in the City. The City is exploring the feasibility of using recycled water on green belts, parks, and other facilities in the future, though capital costs have been a major deterrent. **Table 2-6** summarizes recycled water use in the Region between 2010 and 2015 (California City Water Department 2017).

Table 2-6: Recycled Water Use in the Fremont Basin IRWM Region

Year	Influent Flows (AF)	Pond Golf Course (AF)	Irrigation (%)	Percolation Pond (AF)	Percolation (%)	Process Evaporation and Losses (AF)	Losses (%)
2010	769	405	52.6%	20	2.5%	345	44.8%
2011	619	424	68.5%	9	1.4%	186	30.1%
2012	594	449	75.5%	5	0.8%	139	23.4%
2013	539	435	80.6%	0	0.0%	105	19.4%
2014	672	503	74.8%	5	0.8%	164	24.4%
2015	691	512	74.0%	6	0.9%	173	25.1%
1 Yr Average	675	506	75.0%	7	1.0%	162	24.0%

Source: California City Water Department 2017 (converted from MG)

2.4 Water Quality

2.4.1 Beneficial Uses

State policy for water quality control in California is directed toward achieving the highest water quality consistent with maximum benefit to the people of the State. Beneficial uses of individual water bodies in the Region are designated and maintained by the LRWQCB. The LRWQCB makes these designations to aid in the implementation of effective water quality criteria and control plans. The Water Quality Control Plan for the Lahontan Region (Lahontan Basin Plan) contains the beneficial uses and water quality objectives for the Lahontan Region. Beneficial uses defined in the Lahontan Basin Plan are summarized in **Table 2-7**. The Fremont Hydrologic Unit includes the Hydrologic Areas for Dove Springs (625.10), Kelson Landis (625.20), East Tehachapi (625.30), and Koehn (625.40), and the Antelope Hydrologic Unit includes the Hydrologic areas for Chaffee (626.10) and Gloster (626.30). The beneficial uses for these Hydrologic Areas are summarized in **Table 2-8**. The Lahontan Basin Plan also identifies the beneficial uses of groundwater basins. The beneficial uses of the groundwater basins in the Fremont Basin IRWM Region are summarized in **Table 2-9** (SWRCB Division of Drinking Water 2015).

Table 2-7: Beneficial Uses of Streams in the Fremont Basin IRWM Region

Hydrologic Unit / Subunit Drainage Feature	Beneficial Uses																					
	MUN	AGR	PRO	IND	GWR	FRSH	NAV	POW	REC-1	REC-2	COMM	AQUA	WARM	COLD	SAL	WILD	BIOL	RARE	MIGR	SPWN	WQE	FLD
Tucker Road Wetlands	X	X			X				X	X			X			X					X	X
Wetlands Above New Dam	X				X				X	X			X			X					X	X
E Most Spring in “Tucker Road” Transect	X	X			X				X	X			X			X						
Oak Creek Pass Springs	X	X		X	X				X	X			X			X						
Wetlands/Oak Cr. Pass, 0.5 Miles Downstream from Springs	X			X	X				X	X			X			X					X	X
Oak Creek Canyon Wetlands	X	X			X				X	X			X			X					X	X
Green Spring	X	X			X				X	X			X			X						
Quail Spring	X	X			X				X	X			X			X					X	
Upper Cottonwood Creek	X	X			X				X	X			X			X					X	
Upper Sand Creek	X	X			X				X	X			X			X						
Lower Sand Creek	X	X			X				X	X			X			X						
Upper Cache Creek	X	X			X				X	X			X			X						
Cache Creek	X	X			X				X	X			X			X						
Cache Creek 2	X				X				X	X			X			X						

Hydrologic Unit / Subunit Drainage Feature	Beneficial Uses																				
	MUN	AGR	PRO	IND	GWR	FRSH	NAV	POW	REC-1	REC-2	COMM	AQUA	WARM	COLD	SAL	WILD	BIOL	RARE	MIGR	SPWN	WQE	FLD
Proctor Dry Lake, South of HWY 58	X	X			X				X	X			X			X						
Springs South of Proctor Lake	X	X			X				X	X			X			X						
Wetlands/Cameron Canyon Rd. Off-ramp (W. Bound)	X				X				X	X			X			X					X	X
Lower Cache Creek	X				X				X	X			X			X						
Seep South of Cameron Canyon	X	X			X				X	X			X			X						
Seep on Slopes S. of Cameron Canyon Rd.	X	X			X				X	X			X			X						
Spring W. of Cameron Canyon Rd.	X	X			X				X	X			X			X						
Tehachapi Willow Springs Rd. Wetlands	X				X				X	X			X			X					X	X
Koehn Dry Lake	X	X	X	X	X				X	X			X		X	X						
Mesquite Springs	X	X			X				X	X			X			X						
Red Rock Canyon Creek	X				X				X	X			X			X						
Minor Surface Waters	X	X			X				X	X	X		X			X						
Minor Wetlands	X	X			X	X			X	X			X			X					X	X

MUN: Municipal and Domestic Supply
AGR: Agricultural Supply
PRO: Industrial Process Supply
IND: Industrial Service Supply
GWR: Groundwater Recharge
FRSH: Freshwater Replenishment
NAV: Navigation
POW: Hydropower Generation
REC-1: Water Contact Recreation
REC-2: Noncontact Water Recreation
COMM: Commercial and Sportfishing
AQUA: Aquaculture
WARM: Warm Freshwater Habitat
COLD: Cold Freshwater Habitat
SAL: Inland Saline Water Habitat
WILD: Wildlife Habitat
BIOL: Preservation of Biological Habitats of Special Significance
RARE: Rare, Threatened, or Endangered Species
MIGR: Migration of Aquatic Organisms
SPWN: Spawning, Reproduction, and Development
WQE: Water Quality Enhancement
FLD: Flood Peak Attenuation/Flood Water Storage

Source: SWRCB Division of Drinking Water 2015

Table 2-8: Beneficial Uses of Hydrologic Areas in the Fremont and Antelope Hydrologic Units

Hydrologic Unit / Subunit Drainage Feature	Beneficial Uses																					
	MUN	AGR	PRO	IND	GWR	FRSH	NAV	POW	REC-1	REC-2	COM	AQUA	WAR	COLD	SAL	WILD	BIOL	RARE	MIGR	SPWN	WQE	FLD
Dove Springs Hydrologic Area (625.10)																						
Minor Surface Waters	X	X			X		X		X	X			X			X						
Minor Wetlands	X	X			X	X			X	X			X			X					X	X
Kelson Landis Hydrologic Area (625.20)																						
Minor Surface Waters	X	X			X		X		X	X			X			X						
Minor Wetlands	X	X			X	X			X	X			X			X					X	X
East Tehachapi Hydrologic Area (625.30)																						
Minor Surface Waters	X	X			X		X		X	X			X			X						
Minor Wetlands	X	X			X	X			X	X			X			X					X	X
Koehn Hydrologic Area (625.40)																						
Duck Ponds	X				X		X		X	X			X			X						
Koehn Lake	X				X		X		X	X			X			X						
Mesa Springs, Poison Springs	X	X			X		X		X	X			X			X						
Minor Surface Waters	X	X			X		X		X	X			X			X						
Minor Wetlands	X	X			X	X			X	X			X			X					X	X
Chaffee Hydrologic Area (626.10)																						
Minor Surface Waters	X	X			X				X	X	X		X	X		X						
Minor Wetlands	X	X			X	X			X	X			X			X					X	X
Gloster Hydrologic Area (626.20)																						
Minor Surface Waters	X	X			X				X	X	X		X	X		X						
Minor Wetlands	X	X			X	X			X	X			X			X					X	X

MUN: Municipal and Domestic Supply
AGR: Agricultural Supply
PRO: Industrial Process Supply
IND: Industrial Service Supply
GWR: Groundwater Recharge
FRSH: Freshwater Replenishment
NAV: Navigation
POW: Hydropower Generation
REC-1: Water Contact Recreation
REC-2: Noncontact Water Recreation
COMM: Commercial and Sportfishing
AQUA: Aquaculture
WARM: Warm Freshwater Habitat
COLD: Cold Freshwater Habitat
SAL: Inland Saline Water Habitat
WILD: Wildlife Habitat
BIOL: Preservation of Biological Habitats of Special Significance
RARE: Rare, Threatened, or Endangered Species
MIGR: Migration of Aquatic Organisms
SPWN: Spawning, Reproduction, and Development
WQE: Water Quality Enhancement
FLD: Flood Peak Attenuation/Flood Water Storage

Source: SWRCB Division of Drinking Water 2015

Table 2-9: Beneficial Uses of Groundwater Basins in the Fremont Basin IRWM Region

Basin DWR No.	Basin Name	Beneficial Uses					
		MUN	AGR	IND	FRSH	AQUA	WILD
6-44	Antelope Valley	X	X	X	X		
6-45	Tehachapi Valley East	X	X	X	X		
6-46	Fremont Valley	X	X	X	X		
6-47	Harper Valley	X	X	X	X		
6-50	Cuddeback Valley	X	X	X	X		
6-52	Searles Valley	X[1]		X			
6-54	Indian Wells Valley	X	X	X	X		
6-69	Kelso Lander Valley	X	X		X		

MUN: Municipal and Domestic Supply
AGR: Agricultural Supply
IND: Industrial Service Supply
FRSH: Freshwater Replenishment
AQUA: Aquaculture
WILD: Wildlife Habitat

Notes: MUN designation does not apply to groundwater under the Searles Lake bed, or to the groundwater surrounding the lake. The PRO use applies to the groundwater under the Searles Lake bed.

Source: SWRCB Division of Drinking Water 2015

2.4.2 Groundwater Quality

According to the beneficial water use designations delineated in the Lahontan Basin Plan, groundwater basins in the Region are typically suitable for municipal and domestic supply, agriculture, industrial service supply, and freshwater replenishment. The groundwater quality in the Region is contingent upon historic and existing land use practices, water extractions, industrial discharges, urban and agricultural runoff, and natural conditions. Identification and characterization of salts and nutrients from imported water, recycled water, and other sources is necessary for quantifying pollutant loads and analyzing groundwater quality degradation.

The presence of pollutants such as sodium, calcium, chloride, sulfate, bicarbonate, boron, and nitrates has degraded the groundwater quality in the Fremont Basin IRWM Region. A significant portion of the groundwater basins in the Region contain elevated total dissolved solid (TDS) levels, or dissolved solids such as inorganic salts and small amounts of organic matter. High TDS concentrations can occur naturally depending on the geologic conditions and can lead to hard, odorous, corrosive, colored, and salty water (EPA N.D.c).

Arsenic, hexavalent chromium, nitrate, and perchlorate are constituents of concern in the Region's groundwater basins because they can cause severe adverse health effects. To protect drinking water supplies, the State Water Resources Control Board adopted a Maximum Contaminant Limit (MCL) to be met by public water systems for most of the constituents (i.e., arsenic, nitrate, and perchlorate) as discussed below. The MCL is informed by a Public Health Goal (PHG) that specifies a drinking water concentration that poses no significant health risk if consumed over a lifetime (SWRCB 2107a). While there is currently no MCL for hexavalent chromium, California set a PHG of 0.02 ppb and the constituent is regulated under the MCL for total chromium as discussed below. The following is a summary of these constituents of concern, their sources, and the health effects.

Arsenic: Arsenic is an odorless and tasteless semi-metal element that occurs naturally in rocks and soil, water, air, plants, and animals. It enters drinking water supplies from natural deposits in the earth or from agricultural, industrial, and mining practices. Higher levels of arsenic tend to be found more in groundwater sources than in surface water sources. Arsenic can be toxic in high concentrations and is linked to increased risk of cancer when consumed over a lifetime at or above the regulated Primary MCL of 10 micrograms per liter (μg/L). Other effects include decreased production of red and white blood cells, abnormal heart rhythm, blood-vessel damage, and impaired nerve function (SWRCB 2017c).

Hexavalent Chromium: Chromium-6, is an oxidized form of the metal that is commonly found in low concentrations in drinking water. Chromium-6 occurs naturally in the environment from the erosion of natural chromium deposits, and it can also be produced by industrial processes. There are demonstrated instances of chromium being released to the environment by leakage, poor storage or inadequate industrial waste disposal practices. High concentrations of hexavalent chromium in groundwater are often associated with chrome plating, dyes and pigments, and leather and wood preservation. When ingested, hexavalent chromium can upset the gastrointestinal tract, damage the liver and kidneys, and increase the risk of cancer. California set a PHG of 0.02 ppb or 0.02 μg/L, for hexavalent chromium, and adopted an MCL of 10 μg/L in 2014. However, the hexavalent chromium MCL for drinking water was revoked in 2017 because the California Department of Public Health failed to consider the economic feasibility of compliance when adopting the MCL. Chromium-6 is currently regulated under the 50 μg/L MCL for total chromium (SWRCB 2017d).

Nitrate: Nitrate is a naturally occurring constituent formed when nitrogen-containing organic compounds are broken down in the presence of oxygen. However, elevated concentrations in groundwater are often associated with human activities such as wastewater discharge, fertilizer application and land application of animal wastes. A regulated drinking water contaminant, nitrate has an established California MCL of 10 mg/L as "nitrate as nitrogen" (as N) or 45 mg/L as "nitrate" (NO3). Nitrate is known for causing "blue baby" syndrome among infants under six months. Symptoms include shortness of breath and blueness of the skin around the eyes and mouth. If untreated, "blue baby" syndrome can lead to coma or death (SWRCB 2017e).

Perchlorate: Perchlorate is a naturally occurring contaminant that has been detected in arid environments like the southwestern regions of the United States. High levels of perchlorate can also be attributed to the manufacturing or testing of solid rocket fuels, fireworks, rubber, and certain types of fertilizers. It is also present in matches, automotive air bag inflators, and hazardous waste sites. Common uses of perchlorate include leather tanning and electroplating. Perchlorate disrupts thyroid hormone production in humans, interfering with the body's ability to regulate metabolism and physical growth. Pregnant women are most susceptible to perchlorate contamination, which can cause miscarriages or impaired brain and central nervous system development in fetuses and children. (SWRCB 2017f). Perchlorate has an established MCL of 6 μg/L in drinking water (EPA N.D.b.).

The following sections provide a brief description of the groundwater quality for basins in the Region. Groundwater quality data was provided by the GeoTracker Groundwater Ambient Monitoring and

Assessment Program (GAMA) database maintained by the State Water Resources Control Board (SWRCB). For a more detailed description of the water quality in the FVGB refer to the Fremont Valley Basin GWMP and the Fremont Valley Basin SNMP in Appendix B and C, respectively.

Fremont Valley Groundwater Basin

Groundwater quality in the FVGB was assessed as part of the 2018 Fremont Valley Basin GWMP and Fremont Valley Basin SNMP. Constituent showing elevated concentrations in the basin included TDS near Koehn Lake, as well as localized areas of arsenic, hexavalent chromium, and nitrate. Perchlorate has not been identified as an issue in the Region. For a detailed discussion of water quality in the FVGB, see Appendix B and Appendix C. A summary of the GWMP and SNMP findings is below.

Generally, relatively low TDS concentrations (less than 500 mg/L) are observed throughout most of the basin. Elevated concentrations of TDS above 1,000 mg/L were generally observed around and north of Koehn Lake. If the basin experiences overdraft conditions, there is potential for saline water from under Koehn Lake to migrate into the less saline areas.

Though wells with elevated arsenic concentrations are found throughout the FVGB, two "hot spots" of elevated arsenic exist in the northeastern and southwestern regions of the FVGB, as detailed in the Fremont Valley Basin GWMP (Appendix B). Elevated levels of arsenic have resulted in one of RCWD's wells in the northeastern portion of the FVGB being taken out of service. RCWD was awarded funding through the Proposition 84 Small Community Infrastructure Improvement Program in 2015 to conduct a feasibility study to drill two test wells and conduct a pilot study to investigate treatment options. The feasibility study was completed in 2017. RCWD continues to explore additional funding opportunities to continue to work toward remediating the issue. In the southwestern portion on the basin, some wells used by Golden Queen Mining Company are impacted by elevated levels of arsenic. A limited amount of water from these wells is treated by Golden Queen Mining Company using small treatment units.

Historically, average hexavalent chromium concentrations throughout the FVGB have remained below the previously enforced MCL of 10 μg/L. Average hexavalent chromium concentrations throughout the FVGB have averaged about 4.8 μg/L over the last five years, which is below the PHG of 10 μg/L (and the previously enforced MCL of 10 μg/L) and well below the current regulation of 50 μg/L of total chromium. One well in the central part of California City shows an increasing hexavalent chromium trend. The City plans to monitor water quality at this well and manage any increasing levels of hexavalent chromium. To prevent future hexavalent chromium exceedances, the City is considering options to manage or treat hexavalent chromium levels at this well.

Nitrate-N concentrations are generally low across the basin with most of the wells at concentrations of nitrate-N below the 10 mg/L MCL. A small number of exceedances was noted as part of the SNMP and GWMP. These are likely reflective of localized conditions and not a regional, widespread nitrate issue. One area of nitrate contamination has been identified in the Region at MPUD's well 30. Well 30 was taken out of service due to high levels of Nitrate exceeding the MCL of 10 mg/L of Nitrate-N. The MCL of 45 mg/L of Nitrate-NO3 has also been exceeded. All six of MPUD's wells produce water with low levels of Nitrate-N. MPUD has proposed a nitrate-blending project at well 30 to help mitigate the high nitrate levels at this well and be able to continue to use water from that well as a supply. This project is discussed further in *Chapter 6: Projects*.

Indian Wells Valley Groundwater Basin

The Indian Wells Valley Basin has an average TDS concentration of 390 mg/L. The basin is impaired due to groundwater extractions that have caused poor-quality water from the shallow aquifer to leak into the higher-quality deep aquifer. The aquifer also contains high levels of chloride, boron, and arsenic. Water quality sampling in public supply wells concluded that three wells exceeded the inorganic MCL, two exceeded the radiological MCL, and one exceeded the nitrate MCL (DWR 2004e).

According to GeoTracker GAMA, arsenic has been detected at concentration levels almost 6 times higher than the adopted MCL in the past decade, nitrate has been detected at levels 3 times higher than the MCL, and hexavalent chromium concentration levels have been recorded 170 times higher than the PHG. There have been no perchlorate exceedances recorded in the past 10 years (SWRCB 2017b).

According to the *Indian Wells Valley Groundwater Project* (1993), the United States Department of the Interior Bureau of Reclamation (USBR) found that the southwest area of the Basin contains a significant quantity of high-quality groundwater. In contrast, groundwater in the northwest area was found to be of the poorest quality and has historically been used primarily for agricultural purposes. While areas of nitrate, arsenic and hexavalent chromium contamination have been identified in areas of the basin outside the Fremont Basin IRWM Region, the small portion of the groundwater basin within the Region has no identified areas of contamination for arsenic, hexavalent chromium, nitrate, or perchlorate to note at this time. Treatment systems have been developed at wells that pump groundwater outside the Region.

Kelso Lander Valley Groundwater Basin

Groundwater in the Kelso Lander Valley is characterized by calcium, sodium, bicarbonate, and sulfate. The basin is impaired because of elevated fluoride concentrations that range from 0.9 to 2.3 mg/L and high TDS content that ranges from 360 to 1,300 mg/L. Because of these conditions, the basin is designated for irrigation purposes only (DWR 2004f).

According to data provided by the GeoTracker GAMA database, there have been no detections of arsenic, hexavalent chromium, nitrate, and perchlorate in the Kelso Lander Valley Groundwater Basin. Because no areas of contamination for these constituents have been identified, there are no management actions at this time (SWRCB 2017b).

Harper Valley Groundwater Basin

Groundwater in northern Harper Valley Basin is characterized by sodium sulfate-bicarbonate with elevated concentrations of sodium, fluoride, and boron. In the western portion of the basin, water is predominantly of sodium chloride character also with high concentrations of sodium, fluoride, and boron. The TDS content in this portion ranges from 1,350 to 1,650 mg/L. On the west side of Harper Lake, groundwater contains sodium, chloride, bicarbonate, and sulfate, and an elevated TDS content up to 2,391 mg/L. In the southern part of the basin, groundwater is characterized by calcium-sodium sulfate with high sulfate, boron, and TDS concentrations ranging from 179 to 784 mg/L. The high concentrations of boron, fluoride, and sodium render the basin inferior for irrigation and domestic water uses (DWR 2004d).

Arsenic, hexavalent chromium, and nitrate have all been detected at concentrations higher than their adopted limits in the past decade in the Harper Valley Groundwater Basin. Notably, hexavalent chromium was detected at concentrations more than 96,000 times higher than the set PGH. The

Harper Valley Groundwater Basin has not reported any perchlorate exceedances (SWRCB 2017b). While these are constituents of concern in the larger groundwater basin, specific areas of contamination in the small portion (1 percent) of the Harper Valley Groundwater Basin within the Fremont Basin IRWM Region have not been identified. This portion of the groundwater basin has no identified wells within the Region; therefore, there are no management actions within the Region at this time.

Tehachapi Valley East Groundwater Basin

Groundwater in the Tehachapi Valley East Basin contains TDS ranging from 298 to 405 mg/L. There are no known groundwater impairments listed for the basin according to Bulletin 118 (DWR 2004h). According to data available on GeoTracker GAMA, arsenic has been detected in the Tehachapi Valley East Groundwater Basin at concentrations 8 times higher than the adopted MCL, and hexavalent chromium at concentrations 650 times higher than the PHG. Nitrate and perchlorate have also been detected in the Tehachapi Valley East Basin, but no exceedances have been reported. All GeoTracker GAMA monitoring wells are located outside the IRWM Region boundary (SWRCB 2017b). As such, there are were no specific issues identified within the Region through the water quality monitoring data source.

MPUD operates four wells (well 6, 7, 8, and 9) on the southeastern edge of the Tehachapi Valley East Groundwater Basin near the Fremont Basin IRWM Region boundary along highway 58. Three of these wells (7, 8, and 9) have shown exceedances of arsenic above the MCL. MPUD currently treats water from these wells for arsenic. No additional actions have been identified to address the arsenic levels at this location since treatment is sufficient to treat water to meet drinking water standards.

Cuddeback Valley Groundwater Basin

Groundwater in Cuddeback Valley Basin contains sodium chloride-bicarbonate and sodium chloride. Impairments in the basin include high concentrations of chloride that range from 60 to more than 2,560 mg/L, especially in the northwest region of the basin. Elevated TDS content of 375 to 4,730 mg/L is another factor that impairs the Cuddeback Valley Basin (DWR 2004b).

Because only a small portion (1 percent) of the Cuddeback Valley Groundwater Basin is within the Fremont Basin IRWM Region and no wells were identified in that area, no areas of arsenic, hexavalent chromium, nitrate, or perchlorate contamination were able to be identified within the Region.

Antelope Valley Groundwater Basin

Groundwater quality in the Antelope Valley Groundwater Basin is high within the principal aquifer but degrades toward the northern portion of the dry lakes area. The groundwater is characterized by calcium bicarbonate near the surrounding mountains and by sodium bicarbonate or sodium sulfate in the central part of the Basin. On the eastern side, the upper aquifer has sodium-calcium bicarbonate type water and the lower aquifer has sodium bicarbonate type water. The TDS content ranges from 200 to 800 mg/L, which makes it suitable for domestic, agricultural, and industrial uses. The Basin is impaired by high levels of boron and nitrates (DWR 2004a).

Nitrate levels exceed the current MCL of 45 ppm for drinking water in the southern portion of the groundwater basin, outside the Fremont Basin IRWM Region. These exceedances are most likely due to agricultural fertilization practices and discharge of treated wastewater. Multiple water districts in the Antelope Valley Groundwater Basin have tested arsenic levels above the MCL of 10 ppb. To dilute arsenic concentrations, most wells are blended with surface and groundwater with arsenic concentrations of less than 8 ppb. These wells are located outside the Fremont Basin IRWM Region. Multiple wells in the Antelope Valley Groundwater Basin have also detected hexavalent chromium concentrations significantly times higher than the PHG and some perchlorate exceedances have also been reported to be more than twice the MCL (SWRCB 2017b).

Because only a small portion (0.3 percent) of the Antelope Valley Groundwater Basin is within the Fremont Basin IRWM Region and no wells were identified in that area, no areas of arsenic, hexavalent chromium, nitrate, or perchlorate contamination were able to be identified within the Region.

Searles Valley Groundwater Basin

Groundwater in the northwest part of the Searles Valley Basin has calcium-sodium bicarbonate or sodium-calcium bicarbonate character, whereas in the southeast part of the basin it has calcium-magnesium chloride-bicarbonate character. Water near Searles Lake has sodium chloride character. Groundwater is designated for beneficial uses in the northwest part of the basin, though it is not used for domestic purposes. Groundwater from the southwest part of the basin near Searles Station is suitable for both domestic and irrigation uses. Groundwater near Searles Lake, however, is impaired and cannot be used for any beneficial uses because of high concentrations of fluoride, boron, sodium, chloride, and sulfate, as well as high TDS content that ranges between 12,000 to 420,000 mg/L beneath the lake (DWR 2004g).

Because only a small portion (0.1 percent) of the Searles Valley Groundwater Basin is within the Fremont Basin IRWM Region and no wells were identified in that area, no areas of arsenic, hexavalent chromium, nitrate, or perchlorate contamination were able to be identified within the Region.

2.4.3 Surface Water Quality

Under Section 303(d) of the Clean Water Act (CWA), states must submit to the U.S. EPA a list (known as the "303(d) List") identifying surface waters that do not meet water quality standards. The 303(d) List identifies the pollutants causing impairment and establishes a schedule for developing a control plan. Listed pollutants are generally addressed through pollutant control plans called Total Maximum Daily Loads (TMDLs) that identify the pollutant load that a water body can accept while still meeting water quality standards. There are no surface water bodies within the Fremont Basin IRWM Region listed on the State's 2012 303(d) list (DWR 2012).

2.4.4 Imported Water Quality

Effective monitoring of water diversions and SWP operations is vital for the continued preservation of the Sacramento – San Joaquin Delta's (Delta) natural ecosystem. DWR monitors all SWP processes to ensure compliance with existing water quality standards. DWR regulates non-Delta waters entering the SWP, which typically originate from excess surface flows, flood waters, or "pump back" projects that store imported water in groundwater banks. Proposals for returning water to the SWP must demonstrate that the water is of consistent, predictable, and acceptable quality and will not result in a reduction of SWP water quality. An analysis conducted by AVEK in 2013 concluded that SWP water quality generally meets federal primary and secondary drinking water standards (AVEK 2016). **Table 2-10** compares the SWP water quality conditions (DWR N.D.b.) with current federal drinking water standards (Station KA023173, Check 27 between Edwards Air Force Base and California City).

Table 2-10: Comparison of SWP Water Quality Criteria (2017) to SWP Actual Data

Constituent	SWP Water Quality Data (Sta. KA023173)(1)(d)			Current Drinking Water Standards (2017)(2)(3)
	Maximum	Minimum	Average	
Arsenic (Dissolved) (µg/L)	3	1	2	10
Boron (Dissolved) (µg/L)	300	200	200	No standard
Bromide (Dissolved) (µg/L)	350	120	225	No standard
Chloride (Dissolved) (mg/L)	108	45	74	250(c)
Chromium (Dissolved) (µg/L)	(a)	(a)	(a)	100 (total)
Manganese (µg/L)	(b)	(b)	(b)	50(c)
Nickel (Dissolved) (µg/L)	1	1	1	No standard
Nitrate as N (mg/L)	7.6	<R.L.	2.5	10
Selenium (Dissolved) (µg/L)	<1	< 1	< 1	50
Specific Conductance (uS/cm)	654	340	498	No standard
Sulfate (Dissolved) (mg/L)	72	23	42.4	250(c)
TDS (mg/L)	358	188	283	500(c)
Total Organic Carbon (mg/L)	6.2	1.9	3.85	No standard

Sources: (1) DWR N.D.b. - SWP Water Quality data collected by DWR between 3/5/2012 and 7/15/2014; (2) EPA N.D.a. - US EPA National Drinking Water Standards; (3) EPA N.D.c. - US EPA Secondary Drinking Water Standards
Notes: (a) Contaminant is lower than the Reporting Limit; (b) One sample available; (c) Denotes secondary standard; (d) SWP Water Quality data not shown was not sampled by DWR.

2.4.5 Recycled Water Quality

As discussed in *Section 2.3.5: Wastewater and Recycled Water*, the primary treatment process at the California City WWTP includes an influent pump station, head works consisting of a Parshall flume, mechanical bar screen and sonic flow meter. Secondary treatment consists of one extended aeration activated sludge basin, (split into two cells) two clarifiers and a RAS/WAS pump station. The tertiary treatment facilities consist of filter influent pump station, a chemical mixing/flocculation tank, storage facilities for polymer, alum and chlorine, tertiary sand filters and sodium hypochlorite disinfection. The average nitrate oxide concentration (NO3) of the influent to the WWTP from 2012 – 2017 is 1.45 mg/L. Once treated, the recycled water meets the water quality standards for various end uses, including irrigation and groundwater recharge via percolation ponds (California City Water Department 2017).

2.5 Flood Control

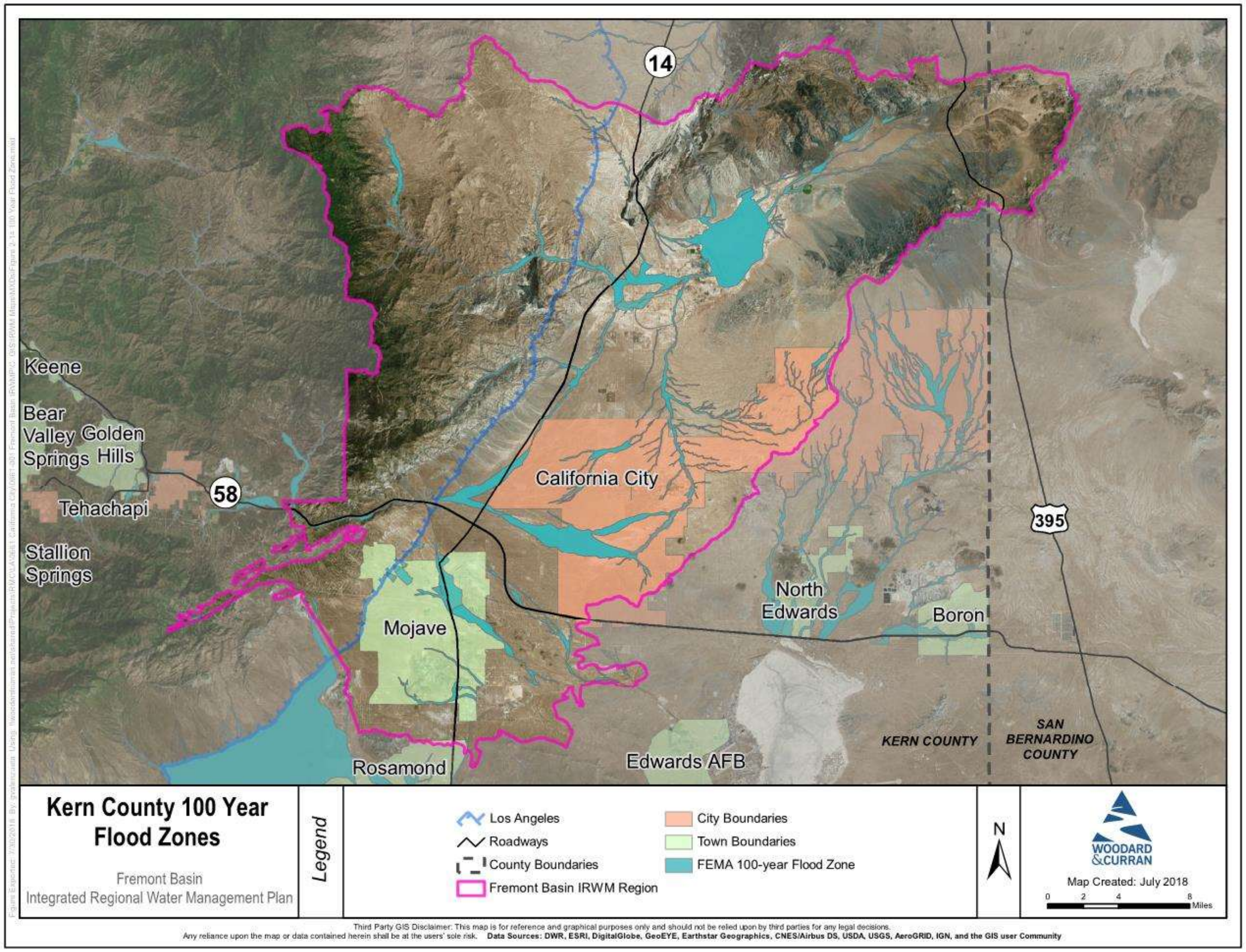
The Mojave Desert is characterized by gently sloping alluvial plains with a series of steep rock buttes and arroyos and poorly defined drainage channels due to previous flooding, erosion, and sedimentation. During seasonal rains, the Region is vulnerable to flooding from drainage off the mountain foothills into the Fremont Valley. Flood problems arise when streams shift across the alluvial plains. Impervious surfaces such as roads and parking lots divert flows, further intensifying floods in the Region (Stetson 2009).

Several areas within the Region, particularly around Cache Creek, are prone to flooding during large storms. One portion of Cache Creek, if breached, could flood part of California City. Flooding issues also occur regularly near Red Rock Canyon and Randsburg Road where flood waters cross the road during major storms, as well as in the town of Mojave. These areas could benefit from improved flood control infrastructure.

The Federal Emergency Management Agency (FEMA) partners with states, communities, and local stakeholders through the Risk Mapping, Assessment, and Planning program to identify flood hazards, assess flood risks, and provide accurate data to guide stakeholders in taking effective mitigation actions that result in safer and more resilient communities. This data is incorporated into flood maps, known as Flood Insurance Rate Maps, that support the National Flood Insurance Program and provide the basis for community floodplain management regulations and flood insurance requirements. The FEMA flood map indicating the inundation areas for a 100-year flood in the Fremont Basin IRWM Region is shown in **Figure 2-15**. The 100-year flood is also referred to as the 1 percent annual exceedance probability flood, meaning that it has a 1 percent chance of occurring in any single year.

Flood control in the Region is managed at both the county level by Kern County and San Bernardino County and at the local level by California City. In its 2009 General Plan, California City has designated the majority of the drainages, floodplains, and flood-hazard areas within its limits as Open Space/Flood Control Facilities, to be used for the protection of residents and property (City of California City 2009). Kern County manages all areas susceptible to flood hazards within the jurisdiction of unincorporated Kern County. Kern County employs various regulations for reducing flood impacts, including restricted land uses in flood-prone areas and limited alternation of natural floodplains that may increase flood damage (Kern County Engineering, Surveying, and Permit Services N.D.). The County allows development within flood hazard areas in accordance with the General Plan and Floodplain Management Ordinance with the appropriate flood evaluations and studies. However, additional floodplain studies are necessary for defining the extent of flood-prone areas and better informing future land use designations (Kern County 2009). Similarly, the San Bernardino County Flood Control District manages areas susceptible to flood hazards in unincorporated areas of the County.

Figure 2-15: 100-Year Flood Zones in the Fremont Basin IRWM Region



2.6 Environmental Resources

The Region provides critical habitat for diverse flora and fauna that have adapted to high desert conditions. To protect the Region's biodiversity and ecosystem, various restoration efforts are underway. This section discusses the environmental resources of the Fremont Basin IRWM Region. **Figure 2-16** highlights the environmental resources of the Region.

2.6.1 Critical Habitats and Species of Special Concern

Desert Tortoise

The Region is home to California's desert tortoise (*Gopherus agassizii).* The desert tortoise is currently listed as threatened by USFWS and by the CDFW due to habitat loss and degradation, tortoise collection for personal or commercial purposes, disease, predation, inadequate regulatory mechanisms for tortoise protection, climate change, and other factors affecting its continued existence (USFWS 2014). The Desert Tortoise Preserve was established in 1974 north of California City, in the northeastern portion of the Fremont Basin IRWM Region, to promote the welfare of the desert tortoise. The Preserve is managed by the United States BLM and the Desert Tortoise Preserve Committee, a non-profit organization whose mission is to recover and conserve tortoises and other rare endangered species in the Mojave and Sonoran deserts. The Committee protects tortoises through land acquisition and stewardship, education, research, and collaborations with donors, stakeholders, and State and Federal government agencies (City of California City 2009; Desert Tortoise Preserve Committee, Inc. N.D.).

In 1988, the Fish and Game Commission established the Fremont Valley Ecological Reserve. The 4,100-acre area provides invaluable desert tortoise habitat and its designation as a Reserve was needed for the continued protection of desert tortoises. Prior to the establishment of the Reserve, the parcel was used for grazing and off-road-vehicle recreation (CDFW 2017).

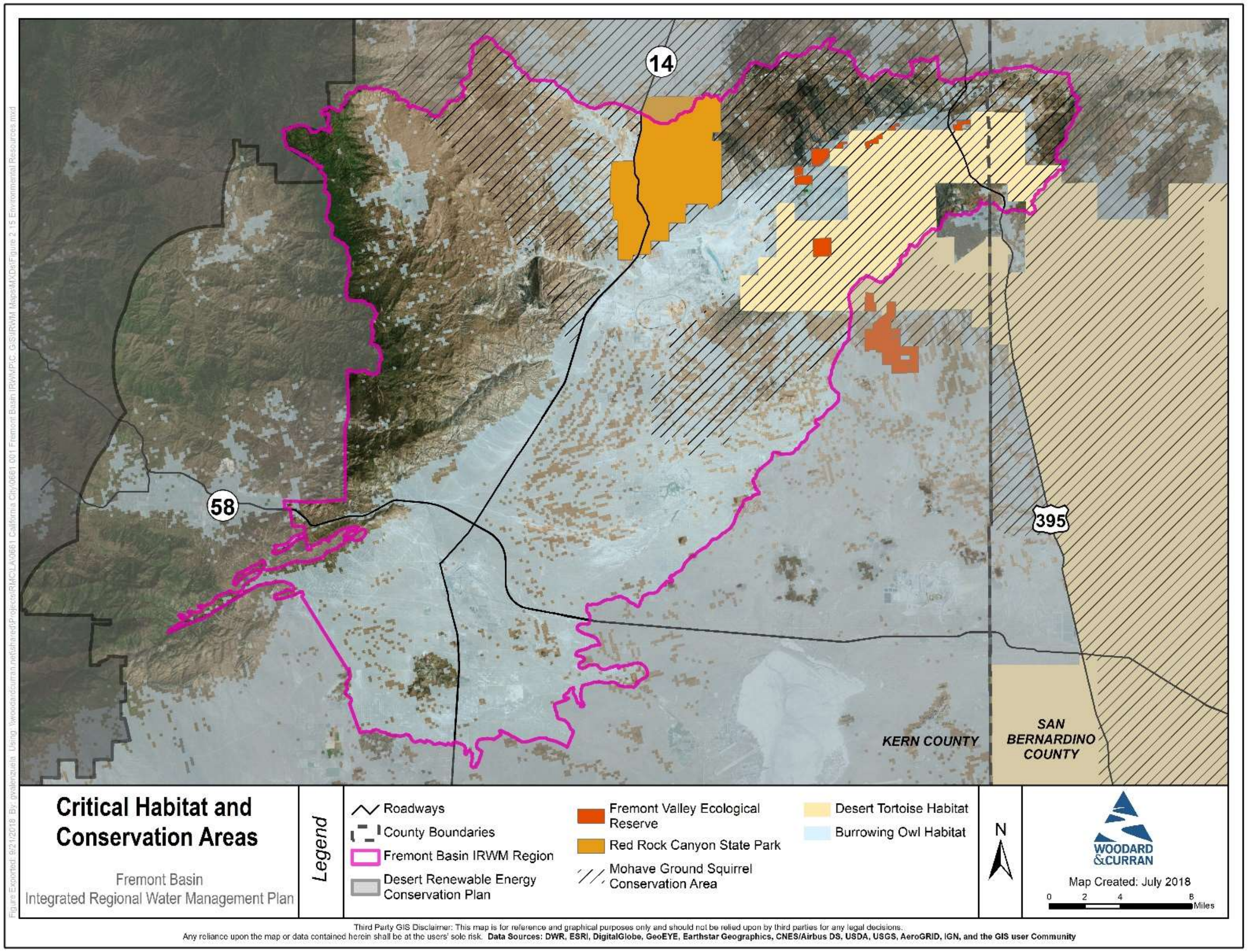
Mohave Ground Squirrel

The Mohave ground squirrel (*Citellus mojavensis*) is endemic to the western Mojave Desert. Significant habitat degradation and fragmentation within the species' historic range has been a consequence of increased motorized recreation, mining, livestock grazing, and transportation infrastructure development in the Region. These anthropogenic pressures have led to a steady decrease in Mohave ground squirrel population numbers. The Mohave ground squirrel is currently listed as Threatened by the CDFW (City of California City N.D.a; Leitner 2015).

Burrowing Owl

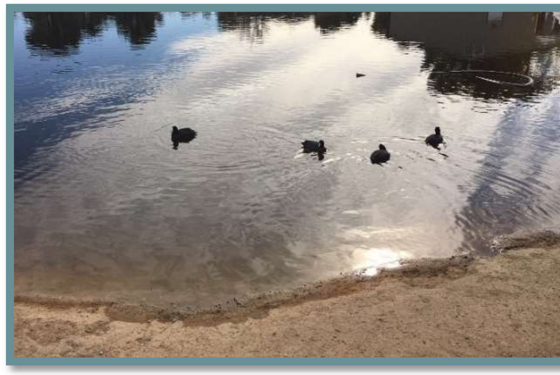
The Mojave Desert is home to the burrowing owl (*Athene cunicularia hypugaea)*. Burrowing Owl populations are threatened by declines in mammal populations like prairie dogs and ground squirrels whose burrows are used for roosting and nesting, habitat loss due to land development, predation, pollution, disease, and illegal hunting. The international Migratory Bird Treaty Act of 1918 protects Burrowing Owls in the United States, Canada, and Mexico. The Burrowing Owl is considered a Bird of Conservation Concern by the USFWS and a Bird Species of Special Concern by the CDFW (USFWS 2003).

Figure 2-16: Critical Habitats and Conservation Areas



Pacific Flyway

The Pacific Flyway is a major north-south migration route for birds, extending from Alaska to Patagonia. Each year, at least one billion birds migrate along the Pacific Flyway, following food sources, heading to breeding grounds, or traveling to wintering sites. This birds that rely on the Pacific Flyway depend on a diverse chain of habitats along the way as rest stops before continuing their migration. While there are limited surface water bodies in the Region, Central Park Lake and other smaller ponds provide habitat for the birds.



Birds using Central Park Lake as habitat along the Pacific Flyway

2.6.2 Regional Conservation Plans

West Mojave Plan

The CDFW, the California Department of Transportation, local jurisdictions, and other regional stakeholders collaborated with the BLM to develop the West Mojave Plan in 2005. The plan is a habitat conservation and federal land use plan that provides management strategies for the desert tortoise, Mojave ground squirrel, and over 100 other plants and animals that are vital for the preservation of these two species. The planning area is located to the north of the Los Angeles metropolitan area and includes the Fremont Basin IRWM Region within its boundaries.

The plan designated 18 Habitat Conservation Areas to be managed by the BLM, four of which were established as Desert Wildlife Management Areas for the protection of desert tortoises. These added a total of 1.5 million acres reserved for tortoise conservation (BLM 2005). The adopted plan also established a Mohave Ground Squirrel Conservation Area comprised of 1.73 million acres of public lands (Leitner 2015). The conservation regions add to the existing 1.15 million acres of land set aside to preserve desert tortoises and are necessary for tortoises to recover from diseases, raven predation, and other pressures. The plan ensures the longevity of tortoise populations, allows for genetic connectivity among tortoise populations, and reduces tortoise mortality resulting from anthropogenic influences (BLM 2005).

Desert Renewable Energy Conservation Plan

The Desert Renewable Energy Conservation Plan (DRECP) is a collaborative plan developed by the Renewable Energy Action Team, whose members include the California Energy Commission, CDFW, the BLM, and the USFWS. The plan covers 22.5 million acres of desert land in seven counties, including the Mojave Desert in Kern County. The DRECP promotes solar, wind, and geothermal energy development in desert regions by streamlining the permitting process for renewable energy projects. Simultaneously, the plan ensures that planning efforts meet state and federal policies, incorporate conservation objectives, and enhance natural ecosystems (BLM 2016).

2.6.3 Groundwater Dependent Ecosystems

Groundwater plays a fundamental role in supporting certain surface ecosystems by providing inflows that maintain adequate water levels, temperature, and chemistry. Springs, rivers, and wetland ecosystems whose health are directly impacted by groundwater conditions are called groundwater dependent ecosystems. While there are low to high groundwater dependent ecosystems found north and west of the Region, there are none present in the Region (Howard & Merrifield 2010).

2.6.4 Red Rock Canyon State Park

Red Rock Canyon State Park is located in the northwestern portion of the Region where the Sierra Nevadas and El Paso Range meet. Roughly 91 percent of the park's 27,000 acres fall within the Fremont Basin IRWM Region. Prior the State Park's establishment in 1968, the area was once home to the Kawaiisu Tribe and served as a Native American trade route. It also hosted mining operations around 1893. The State Park is now managed by the California Department of Parks and Recreation and offers a variety of recreational opportunities such as camping, hiking, equestrian use, and off-highway vehicle recreation. Roadrunners, squirrels, and hawks are a few of the species frequently encountered at the park (CA Department of Parks and Recreation 2005).

Red Rock Canyon State Park

2.7 Land Use

Land use in the FVGB is predominantly comprised of undeveloped lands, urban lands, and a small percentage of developed agricultural lands. The major land use categories within the Region, as identified in the Kern County General Plan, are described below and depicted in **Figure 2-17**. A breakdown of each major land use category in the Region is defined as follows:

- Residential category uses include a mix of housing developed at varying densities. Residential densities in the Region range from "estate" (i.e., large lot parcels) to low, medium low, medium, and high densities. Single-family, multiple-family, condominium, mobile home, and senior housing are included within these categories.
- Commercial category includes commercial uses that offer goods for sale to the public (retail) and service and professional businesses housed in offices (doctors, accountants, architects, etc.). Neighborhood commercial includes retail businesses that serve local needs in a neighborhood area, such as restaurants, neighborhood markets, and dry cleaners. Community commercial businesses are those that serve community or regional needs, such as entertainment complexes, auto dealers, and furniture stores.
- Industrial category includes heavy industrial areas which are lands designated for intensive manufacturing, processing, and storing of materials. Light industrial and research is also included within this category. These non-intensive manufacturing processes are found in research and office park developments and areas adjacent to residential lands. Light

industrial activities include some types of assembly work, utility infrastructure and work yards, solar energy production, wholesaling, and warehousing.

- Resources category encompasses land used for private and public recreational open spaces, and local and regional parks. Recreational use areas include golf courses, cemeteries, water bodies and water storage. Also included in this category are conservation and restoration areas, as well as mineral exploration.
- Agriculture category includes areas devoted to the production of irrigated crops, including alfalfa and pistachio production in recent years, and in some cases goats and cattle.
- Public Facilities category includes facilities used for public or semi-public services including airports, treatment plants, and water spreading areas.
- Vacant lands are undeveloped lands that are not preserved in perpetuity as open space or for other public purposes.

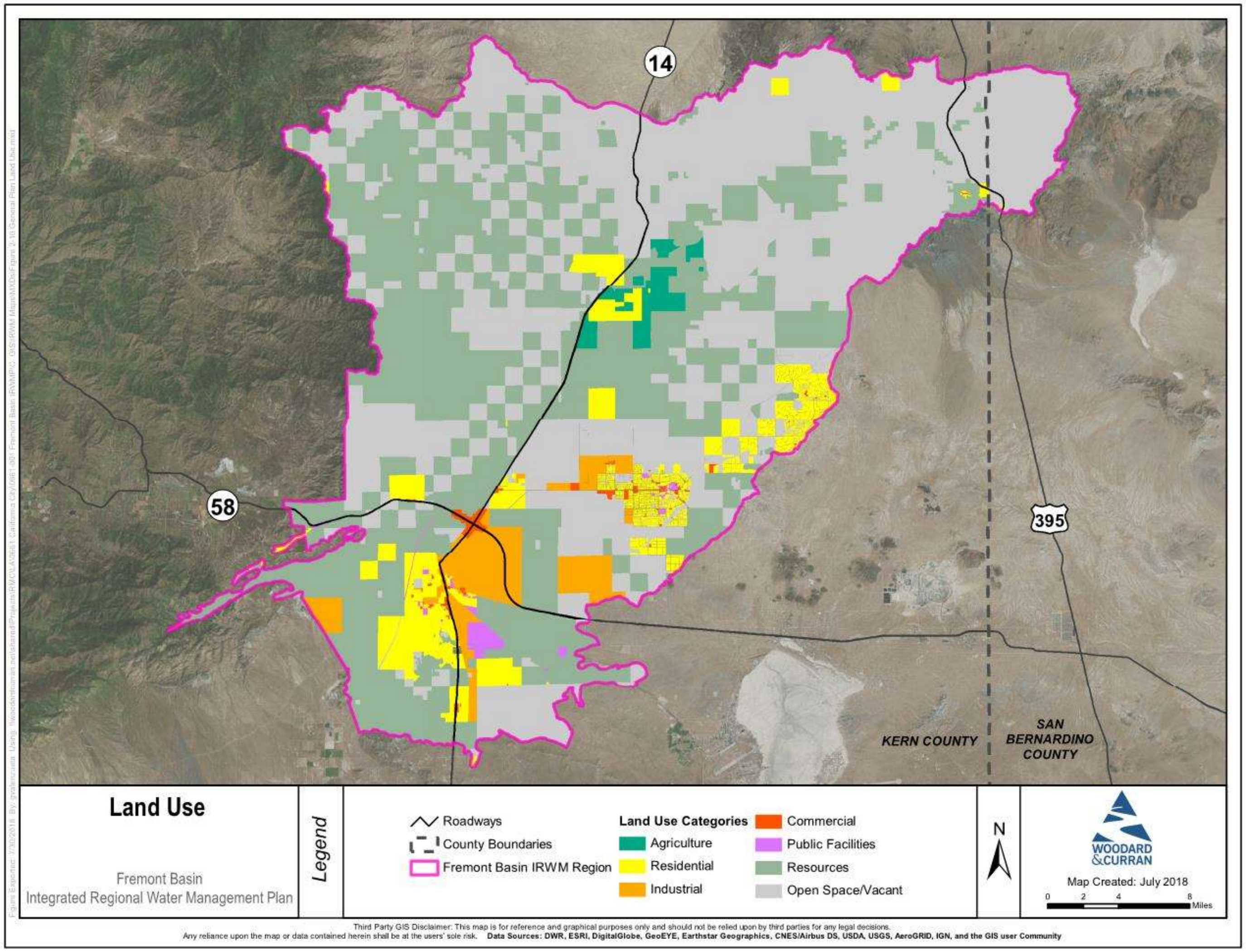
Growth in Kern County is expected to continue as a result of an influx of new residents from outside the County and by natural population increase in the area. This growth points to a need to balance new residential development against other land use requirements within the County. For example, urban expansion into agriculture or open space areas can create the potential for land use conflicts and make it difficult to provide public services to low density residential areas. Commercial and public facilities will likely need to expand to support the increasing residential population (Kern County 2009).

In 2009, the City Council of the City of California City adopted an updated General Plan. The General Plan outlines the vision for the City's future and includes implementation measures to meet the vision. Planning and development decisions are made consistent with the goals and policies delineated in the General Plan. The planning area is comprised of the City's corporate limits and its sphere of influence, totaling 130,200 acres of land located on the western edge of the Mojave Desert in eastern Kern County (City of California City 2009).

The General Plan for the City of California City designates 22,000 acres of land intended for future development in the central core of the City. While development in the northeastern portion of the City can still occur, as evidenced by the construction of the California City Correctional Facility, future development plans are expected to promote housing and open spaces, jobs, accommodate transportation needs, and reduce air and noise pollution (City of California City 2009). The major future developed planned currently is the expansion of the CoreCivic Correctional Facility.

One notable impact to future land use in the Region is cannabis production. In 2016, California voters legalized cannabis in the State of California. California City was one of the first municipalities in Kern County to permit cannabis cultivation, and land designation for these types of agricultural land uses is underway. The City expects a land use designation increase for indoor cultivation facilities, hemp outdoor cultivation facilities, processing and packaging facilities, distribution and transport facilities, and retail cannabis stores. In addition, a municipal ordinance enacted in 2017 increased the maximum number of each type of medical marijuana business that may operate at the same time within the City (City of California City N.D.b). The anticipated impacts on water use in the Region are discussed in *Chapter 3: Supply and Demand Assessment*.

Figure 2-17: Land Use in the Fremont Basin IRWM Region



In 2017, Kern County drafted a Cannabis Land Use Ordinance that proposed regulations for cannabis cultivation; this Ordinance did not pass and no legal cannabis cultivation is anticipated in the planning horizon for the unincorporated areas of the Region.

In 2004, Kern County adopted its General Plan and has completed several updates since then. The County General Plan's Land Use, Open Space, and Conservation element designates the proposed general distribution, location, and extent of land uses in unincorporated areas. The focus of the General Plan discussion is on ensuring future economic growth while conserving the County's agricultural, natural, and resource attributes (Kern County 2009).

Both the City and County General Plans were used to help describe the current and future land use conditions in the Region. The City of California City and the Kern County Planning and Natural Resources Department were consulted during Plan development to ensure current land use planning initiatives and processes were incorporated. Land use through 2028 according to the County and City General Plans is shown in **Figure 2-17**. Current land use is described in detail in the Fremont Valley Basin SNMP (Appendix C).

2.8 Social and Cultural Setting

2.8.1 Population and Demographics

The Fremont Basin IRWM Region is a lightly populated area with only one incorporated City. U.S. Census data for the City and the unincorporated areas of the Region was reviewed for population estimates in the Region and used with additional information about population spread within block groups based on water purveyor service area populations. In 2015, the Region's population is estimated to have reached approximately 19,400, as shown in **Table 2-11** and **Figure 2-18.** By 2040, Region population is expected to grow to approximately 29,400 residents.

Population in the unincorporated area of the Region was determined by normalizing U.S. Census data to the Region boundary using geographic information systems (GIS) mapping and verifying estimated populations with the various water purveyors in the Region. Population projections for the unincorporated areas of the Fremont Basin IRWM Region were determined using California Department of Finance data. It was assumed that the unincorporated area would have a similar growth rate to that of Kern County as a whole, which is estimated at approximately 1 percent per year through 2020, 1.4 percent to 2030, 1.3 percent to 2035, and 1.2 percent to 2040 (CA Department of Finance 2017). Projections indicate that the population in the unincorporated areas will reach approximately 5,500 individuals by 2020 and 7,200 individuals by 2040, as shown in **Table 2-11** and **Figure 2-18.** This represents an increase of approximately 37 percent compared to 2015 population estimates. In Kern County, the median age range is, and is expected to continue to be, 30-34 years through 2040.

Though not all of California City falls within the Region, the City is the only municipality in the Region and houses a large portion of the Region's population. Population estimates in the IRWM Plan assume that all residents are within IRWM Region boundaries. While the population in California City remained at approximately 3,000 individuals from 1965 to 1980, it steadily increased the following two decades, reaching approximately 8,385 residents by 2000. The City had a reduction in population from 2009 to 2012, following the 2008 nationwide economic downturn. Population has since rebounded and the City reached approximately 14,200 residents in 2015. As shown in **Figure 2-18.**

and **Table 2-11**. California City's population within the Region is expected to reach approximately 22,300 by 2040 (California City Water Department 2017). These projections assume that the 1.5 percent growth rate provided by the Department of Finance for California City between 2016-2017 will remain constant through 2040.

Based on California City data collected for the 2010 U.S. Census:

- 59 percent of the population identified as male;
- Roughly 40 percent of residents identified as white, 38 percent as Hispanic or Latino, 14.5 percent as black of African American descent; the remaining 7.5 percent identified as 'other;'
- Roughly two-thirds of residents owned their housing units; and
- The average household size was 2.8 residents.

Figure 2-18: Fremont Basin IRWM Region Population

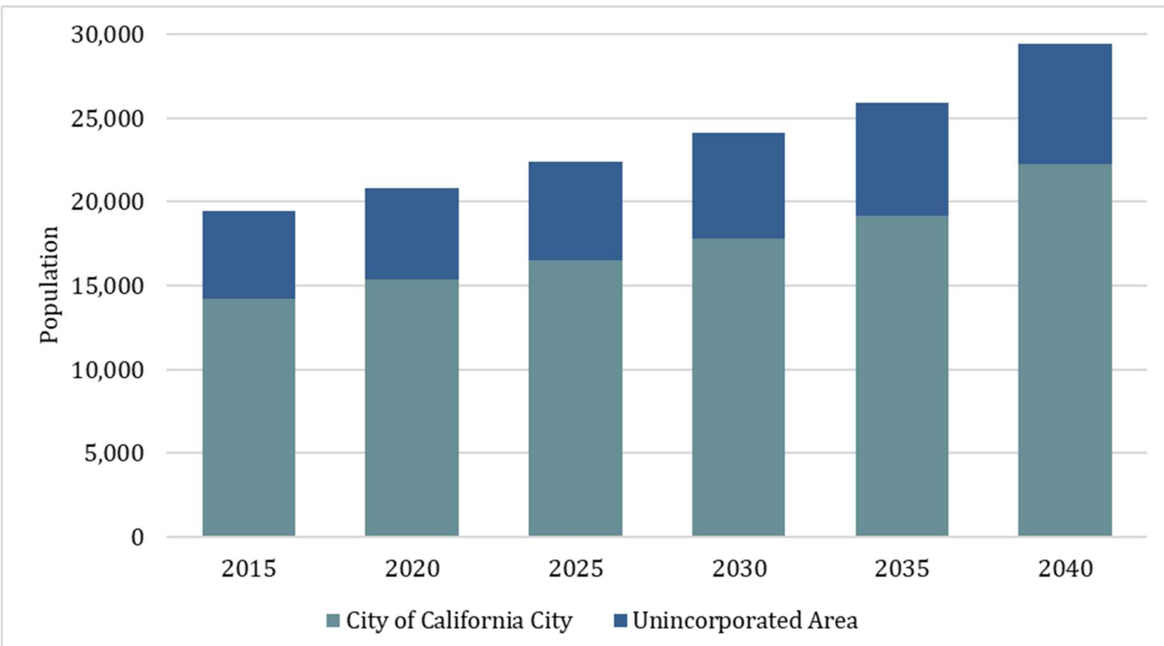


Table 2-11: Fremont Basin IRMW Region Population Projections

	2015	2020	2025	2030	2035	2040
Unincorporated Area Population[1]	5,200	5,500	5,900	6,300	6,700	7,200
California City Population[2]	14,200	15,300	16,500	17,800	19,200	22,200
Total Region Population	**19,400**	**20,800**	**22,400**	**24,100**	**25,900**	**29,400**

Sources: (1) 2010 U.S. Census Data, normalized by the Region boundary and water purveyors service populations; (2) California City Water Department 2017

Note: Population estimates rounded to the nearest hundred.

2.8.2 Economic Factors

Historically, California City was a central hub for mining operations with labor provided by the Native American Paiute Tribe. In the 1880's, the Region became a vital passageway for the transportation of borax ore from Death Valley to the railhead in Mojave and for mines operating in the area. The Region then transitioned to sheep farming and cultivation of alfalfa and cotton. The economic base of the Region eventually grew to depend on land sales and development activities (City of California City N.D.a).

Mojave Air and Space Port in Mojave, CA

California City population has increased over the past few decades in response to increased employment opportunities. Employers in Kern County include the Air Force Base located four miles southeast of the City outside the Region, the Mojave Air and Space Port within the town of Mojave at the intersection of Highways 14 and 58, the Hyundai/Kia Automotive Test Facility, and the Honda Proving Center. The California Correctional Center is operated by the CA Department of Corrections and Rehabilitation and is the largest employer within California City. Extraction of borates by the Rio Tinto Mine (formerly U.S. Borax Boron Mine) fifteen miles east of the City, outside the Region, also provides lucrative employment opportunities for residents in the Region (California City Water Department 2017). The emerging cannabis industry will also likely provide new employment opportunities for residents in the Region, specifically in the cultivation, processing, transport, and retail of medical and recreational marijuana.

For Kern County as a whole, energy development is and will continue to be vital for the economy. As a major producer of oil, natural gas, and electricity, as well as its proximity to gas and electric utilities, Kern County provides reliable employment opportunities to its residents. Kern County is a leader in wind energy production and has the potential to advance solar and high-temperature geothermal resources. Petroleum and renewable energy resources are invaluable to the State's electricity supply (Kern County 2009).

Within the Fremont Basin IRWM Region, solar energy production is a major industry. Beacon Solar, LLC currently operates a roughly 2,500-acre photovoltaic solar facility one mile southwest of Cantil and Rancho Seco (Kern County Planning and Community Development Department 2012). This facility consists of five solar power station projects and is anticipated to generate approximately 250 megawatts (MW) for the Los Angeles Department of Water and Power (LADWP).

Two other solar photovoltaic projects in the Region include Springbok and Barren Ridge 1 (Kern County 2013). Springbok solar farm, comprised of 3 projects (Springbok 1, 2, and 3), is located on the eastern side of highway 14 near Rancho Seco and Cantil. Springbok 1 and 2, constructed in 2016, provide a combined 328 MW. Springbok 3 is anticipated to be complete by the end of 2019 and will provide 115 MW. Barren Ridge 1 is a 78 MW facility located that along the western side of highway 14 north of California City that began operating in 2016. Recurrent Energy estimates that the project

Solar and wind energy production near Mojave, CA

will generate roughly $9.6M in tax revenue for Kern County (Recurrent Energy n.d.). As with the Beacon Solar project, LADWP purchases power from Springbok and Barren Ridge 1. Additional solar and wind energy projects are located in the southern portion of the Region near the town of Mojave.

Other important industries in the Region include mining and manufacturing. In the southern portion of the Region, Golden Queen Mining Company uses conventional open pit mining methods to extract gold and silver at the Soledad Mountain Mine, which is located 5 miles south of Mojave. Golden Queen Mining Company has been in operation since the 1980's, but did not begin mining production until 2015. Activities at the site include construction of infrastructure to support exploration activities, drilling, and mining. Since 2006, Golden Queen Mining has also invested more than half a million dollars to cleanup illegal dumping and remnants from historical mining operations in the northern slopes of Soledad Mountain (Golden Queen Mining N.D.).

The largest manufacturing company in the Region is the California Portland Company (CalPortland Company) that been in operation in the southern portion of the Region since the 1950's. CalPortland Company is the largest producer of sand, gravel and quarry rock in the Pacific Northwest. CalPortland Company owns and operates three cement plants in the United States, one of which is located in Mojave. The "Mojave Cement Plant" has an annual manufacturing capacity of 1.44 million tons of cement clinker, along with a nearby quarry to extract limestone and clay for use in cement production (EPA 2011).

2.8.3 Disadvantaged Communities

Disadvantaged communities (DACs) are defined as communities whose annual MHI is less than or equal to 80% of the statewide MHI. Using block group data from the 5-Year (2012-2016) American Community Survey (ACS) dataset, DACs are those communities with an MHI of $49,191 or less. Severely disadvantaged communities (SDACs) have an MHI that is less than or equal to 60 percent of the statewide MHI (or $36,893). The DAC area, roughly 228 square miles, and the SDAC area, roughly 688 square miles, are shown in **Figure 2-19**. The combined DAC and SDAC area covers 92 percent, or 916 square miles, of the Region's area, as documented in **Table 2-12**. Additionally, according to the 2012-2016 ACS dataset, there are 3 census designated places within the Region with recorded MHI information: the City of California City is classified as a DAC, and the unincorporated towns of Mojave and Johannesburg are classified as SDACs (ACS 2016).

Figure 2-19: Disadvantaged Communities in the Fremont Basin IRWM Region

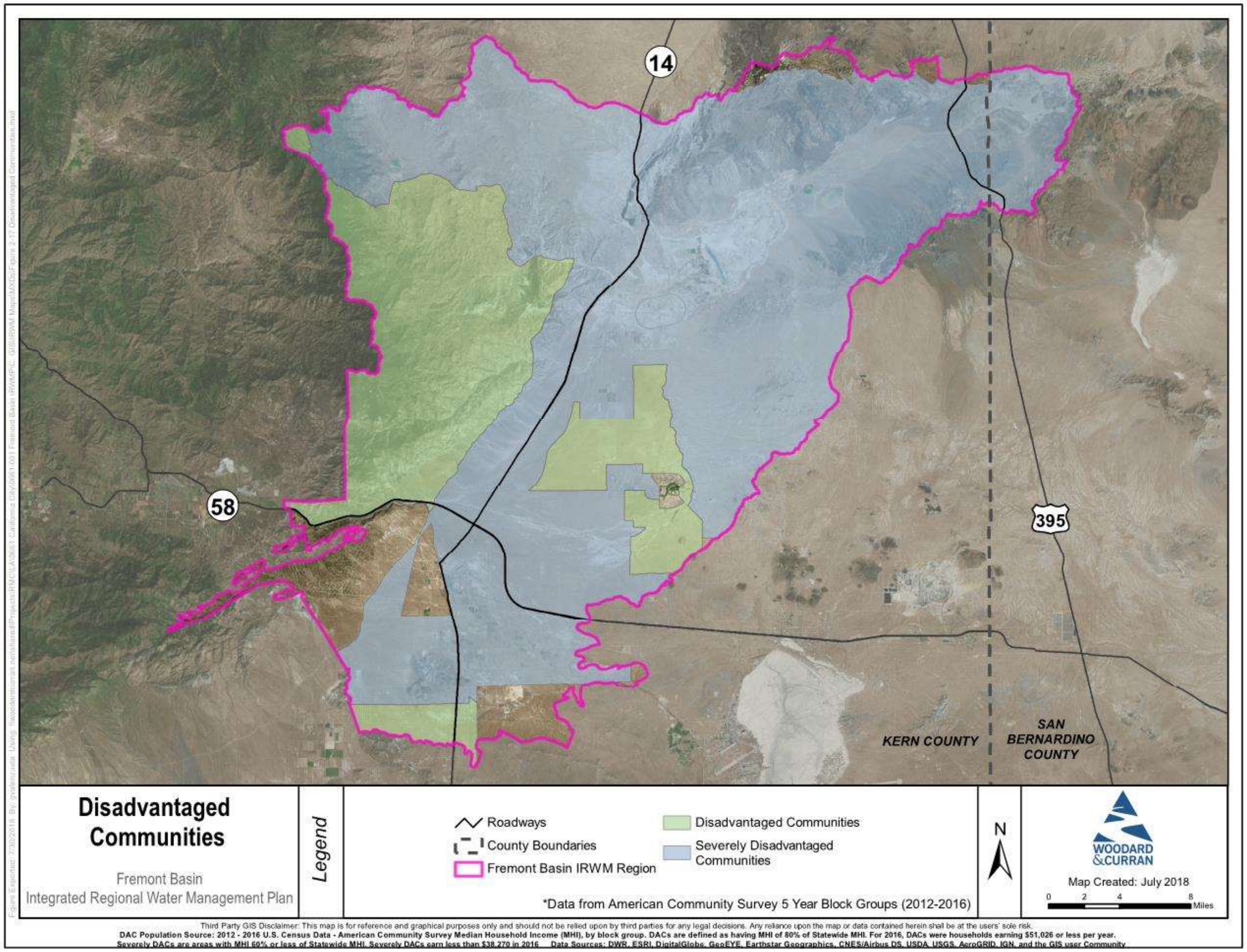


Table 2-12: Disadvantaged Community Area

Geographic Area Description	Area
Fremont Basin IRWM Region	992 square miles
DAC and SDAC Area within Fremont Basin IRWM Region	916 square miles
DAC/SDAC Coverage as % of Region Area	92%

Source: 5-Year 2012-2016 American Community Survey Block Group data

2.8.4 Tribal Communities

While there are no federally recognized tribes in the Region, there are some parcels of land currently held in Trust by the U.S. government and are known as a Public Domain Allotment. The parcels are not directly a part of a recognized reservation. Collectively, these areas amount to 163 acres of land as identified in **Figure 2-9** (DWR 2014a). The Fremont Basin IRWM Region contacted the NAHC to determine if the Region is home to any tribes or tribal interests. The NAHC responded with a list of 10 organizations representing 14 tribes, as identified in **Table 2-13.** Each of these tribes were contacted during the early stages of IRWMP development in October 2017 and again when the IRWM boundaries were being modified in spring 2018. Two tribes responded, potentially having ancestral territory in the Region: the San Manuel Band of Mission Indians and the Tejon Indian Tribe. IRWM information was emailed to both these tribes, inquiring whether the tribes were currently within the Fremont Basin IRWM Region and inviting the tribes to participate in Plan development. It is not clear which tribe originally lived on the parcel of land held in Trust within the Region. The San Manuel Band of Mission Indians deferred to the Tejon Indian Tribe as a potential stakeholder for consultation during the 2019 IRWMP development. Following further communication with the Tejon Indian Tribe, neither tribe chose to engage in the 2019 Plan development.

Table 2-13: Fremont Basin IRWM Region Tribal Notifications

Organization	Tribe(s) Representing
Big Pine Paiute Tribe of the Owens Valley	Paiute and Paiute-Shoshone
Chumash Council of Bakersfield	Chumash
Kern Valley Indian Community	Kawaiisu and Tubatulabal
Kitanemuk & Yowlumme Tejon Indians	Yowlumne and Kitanemuk
San Manuel Band of Mission Indians	Serrano
Santa Rosa Indian Community of the Santa Rosa Rancheria	Tache, Tachi, and Yokut
Tejon Indian Tribe	Kitanemuk
Tubatulabals of Kern County	Tubatulabal
Tule River Indian Tribe	Yokuts
Wuksache Indian Tribe/Ecshom Valley Band	Foothill Yokuts, Mono, and Wuksache

2.9 Climate Change

As anthropogenic greenhouse gas (GHG) emissions continue to rise, more solar energy is trapped in the atmosphere. This intensifies the greenhouse gas effect which leads to warmer average temperatures worldwide. Climate change is having a progressively more profound impact on California water resources; this impact is expected to intensify in the coming decades. The State's ability to effectively provide a reliable water supply, manage floods, protect ecosystems, and comply with other statewide objectives is threatened by climate change. To meet the needs of all water demands in California, effective resource management requires identifying state-wide impacts that will affect local water resources. Once identified, these impacts can inform water managers of appropriate mitigation and adaptation strategies (DWR, et al. 2011). The following are a few of the key Statewide impacts that temperature increases and precipitation changes will yield.

Impacts due to temperatures increases:

- More winter precipitation will fall as rain rather than snow, decreasing the average snow pack in the Sierra Nevada Mountains. As a result, long-term soil humidity, groundwater and downstream flows, and imported water deliveries will decrease.
- Sea level rise will threaten levees in the Delta and cause saltwater intrusion.
- Droughts, heat waves, storms, and wildfires will become more frequent, longer, and more severe.
- Species sensitive to extreme weather events will be in danger and invasive species will become harder to manage.
- Irrigation demands will increase as temperatures alter evapotranspiration rates, growing seasons become longer, and droughts become more common.
- Evaporation rates will increase, leading to surface water quality issues associated with changes in dissolved oxygen levels, increased algal blooms, and increased concentrations of salinity and other constituents.
- Habitats for temperature-sensitive fish and other life forms will be threatened, especially those susceptible to eutrophication.

Impacts due to precipitation changes:

- More intense storms will exacerbate flooding.
- Water supply will decrease because of the inability to capture precipitation from more intense storms.
- Water quality will decrease due to increased turbidity caused by more extreme storm events, leading to increased water treatment needs and impacts to habitat.
- Vegetation cover will change as a result of increased wildfires and less frequent, but more intense rainfall.

Since climate change projections are dependent on geography, GHG emissions, infrastructure, mitigation measures, and other influences, the extent of these changes is still uncertain. However, there is a strong consensus among the scientific community that change will occur. To effectively incorporate mitigation and adaptation strategies into water resources planning, it is important to understand how these changes will manifest locally. Implementation of these strategies will require flexibility to incorporate new data and information as it becomes available (DWR, et al. 2011).

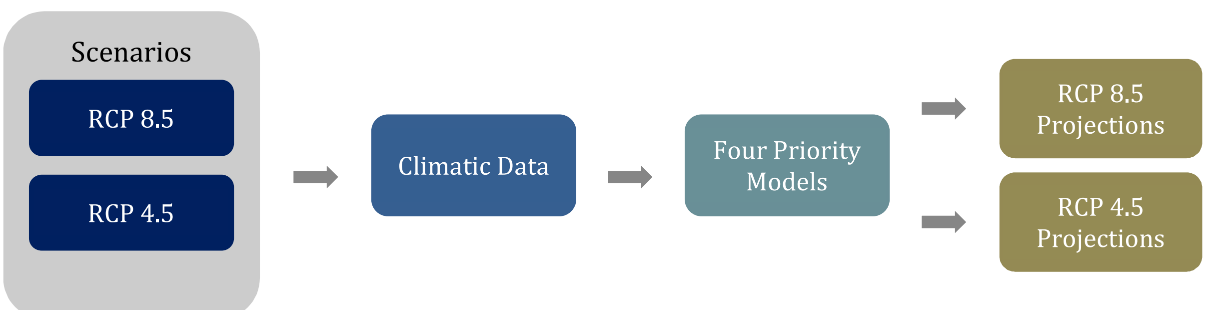
2.9.1 Climate Change Impacts on the Region

A vulnerability is defined as the degree to which a system is exposed to, susceptible to, and able to cope with and adapt to the adverse effects of climate change (DWR, et al. 2011). Each region has unique vulnerabilities to climate change, and having a deeper understanding of these vulnerabilities is the first step toward integrating climate change considerations into future regional water management plans and measures.

Cal-Adapt Climate Tools

Estimating climate change impacts on precipitation and temperature on a regional level is challenging because of the coarse spatial scale of many global climate models. To better comprehend climate change impacts at a local level, the California Energy Commission funded and advised the development of Cal-Adapt, a web-based resource for projecting local risks posed by climate change. Cal-Adapt projects climate change impacts under two potential GHG emissions scenarios outlined in the Intergovernmental Panel on Climate Change's (IPCC) Climate Change 2014 Synthesis Report, a leading international assessment of climate change. The first scenario, Representative Concentration Pathway (RCP) 4.5, assumes GHG emissions will peak around 2040 and then decline. The second scenario, RCP 8.5, assumes that GHG emissions will continue to rise through 2100. Cal-Adapt synthesizes robust scientific data under the two scenarios and applies four models selected by California state agencies as priority models for research contributing to California's Fourth Climate Change Assessment. The climate change modeling process is shown in **Figure 2-20** (California Energy Commission 2017).

Figure 2-20: Cal-Adopt Model for Climate Change Impacts



Climate Change Projections for the Region

Cal-Adapt climate tools were used to project regional changes in temperature, precipitation, wildfire risk, and other impacts posed by climate change. The projections do not factor policy, technology, behavior, and other unidentified variables that influence the evolution of climate change in California. Climate change impacts were compared against historical annual means for 1961 to 1990, as was done by the IPCC when analyzing the global climate dataset. Where regional climate change impacts were not available through the Cal-Adapt website, other resources were utilized, including the California Adaptation Planning Guide (California Emergency Management & Natural Resources

Agency 2012) and the Using Future Climate Projections to Support Water Resources Decision Making in California report (DWR 2009). **Table 2-14** summarizes the impacts and effects of climate change on the Fremont Basin IRWM Region through 2100 under both GHG emission scenarios.

Table 2-14: Impacts of Climate Change on the Fremont Basin IRWM Region

Effect	Ranges
Temperature[1]	• 4°F (RCP 4.5) to 6°F (RCP 8.5) increase by 2050[(b)] • 6°F (RCP 4.5) to 11°F (RCP 8.5) increase by 2100[(c)]
Extreme Heat Days[1(a)]	• 18 (RCP 4.5) to 28 (RCP 8.5) additional days above threshold by 2050[(b)] • 31 (RCP 4.5) to 60 (RCP 8.5) additional days above threshold by 2100[(c)]
Wildfire Risk[1]	• 30 (RCP 4.5) to 104 (RCP 8.5) less hectares burned by 2050[(b)] • 70 (RCP 4.5) to 177 (RCP 8.5) less hectares burned by 2100[(c)]
Precipitation[1]	• 0.8” (RCP 4.5) to -0.8” (RCP 8.5) change by 2050[(b)] • 0.1” (RCP 4.5) to 0.3” (RCP 8.5) change by 2100[(c)]
Flood Management[2]	• Rapid snowmelt and intense rains will result in extreme, high-flow events
Supply[3]	• SWP: delivery decrease of 7-10% by 2050, and 21-25% by 2100 • Changes to local supply not quantified, but supply could decrease based on precipitation effects described above
Demand	• Changes to demand not quantified, but irrigation demand could increase as a result of less precipitation

Sources: (1) Cal-Adapt Climate website http://cal-adapt.org/; (2) California Emergency Management & Natural Resources Agency 2012; (3) California Climate Change Center 2009

Notes: (a) Impacts modeled for California City; (b) Average of 2045 to 2055 projections; (c) Average of 2095 to 2100 projections

Temperature

Between 1961 and 1990, the Region experienced a historical annual mean minimum temperature of 46.1°F and annual mean maximum temperature of 73.2°F. Average temperatures are expected to increase at least 6 to 11 degrees Fahrenheit by 2100 due to climate change (California Energy Commission 2017). This will have adverse impacts on the ecology and productivity of the Region. Threatened species are especially sensitive to climate variations and may have a lowered capacity to adapt to climate change. Foraging may become harder for the Desert Tortoise since their food source is highly dependent on cool season rains (USFWS 2014). Suitable habitats for Mohave Ground Squirrels are also expected to decrease with increased temperatures (Philip 2015). Invasive species that thrive in the warmer climate could become more prevalent and displace local native species.

A warmer climate will also have negative impacts on agriculture as it will increase evapotranspiration, decrease soil moisture, and increase agricultural water demand. Pistachio cultivation, a common crop in the Region, could be especially hindered since nut trees require adequate winter chill to produce viable yields (Semitropic Water Storage District 2015).

Extreme Heat Day

An extreme heat day is defined as a day in April through October where the temperature exceeds the 98th historical percentile of maximum temperatures based on daily temperature data between 1961 and 1990. From 1961 to 1990, California City experienced an average of four extreme heat days per year. Extreme heat days are expected to become significantly more frequent, longer, and more intense. Models project that California City will experience 31 to 60 days more extreme heat days annually by 2100 (California Energy Commission 2017). Longer heat waves pose a serious public health issue as they increase the risk of heat strokes, heat exhaustion, dehydration, and mortality. Heat waves decrease work productivity and will particularly affect agricultural and construction workers as well as homeless populations, children, and women (IPCC 2014). Extreme heat days will also result in increased energy usage associated with air-conditioning, increasing GHG emissions and further perpetuating climate change.

Severe heat waves will also impact ecosystems and biodiversity in the Region. Species unable to adapt to longer and more intense heat waves are at risk of extinction, which will have cascading effects on other organisms connected through food webs and other interactions. Invasive species best suited to the changing conditions can outcompete native species not able to adapt to the changing conditions (EPA 2010).

Wildfire

Historically, an annual average of approximately 530 hectares per year is estimated to have burned in the Region between 1961 and 1990. Wildfire burn area is projected to decrease by roughly 70 to 180 hectares annually by 2100 due to projected decreases in vegetation cover. Reduced vegetation due to urbanization from population growth as well as declines in vegetation cover caused by the temperature and precipitation changes can reduce wildfire burn area, despite drier conditions.

Climate change can impact vegetation cover in the Fremont Valley.

Precipitation and Flood Management

Between 1961 and 1990, the Region received an average annual precipitation of 7.8 inches. Despite changing climate conditions, this annual average is expected to remain relatively unchanged through 2100 (California Energy Commission 2017). Despite the minimal impact on total annual precipitation, climate change is expected to result in a larger proportion of precipitation coming in the form of intense single-day events (EPA 2017). High-flow events will increase the risk of flooding as well as increase the difficulty of retaining water for flood attenuation and groundwater recharge (California Emergency Management & Natural Resources Agency 2012). Longer drought periods will strain water supplies in the Region, as water demand is expected to increase while supplies decrease. Increased precipitation variability will also have adverse impacts on ecosystems as it will endanger species that are unable to adapt to longer droughts and extreme storm events.

Water Supply

The Region receives imported SWP water from the Delta, a climate-sensitive watershed. The Sacramento and San Joaquin Rivers are the primary sources to the Delta, and both are supplied by snowmelt from the Sierra Nevada Mountains. Groundwater basins that supply water to the Region are also recharged from seasonal streams that originate in the Sierra Nevada Mountains. Because of increased temperatures, more precipitation will fall as rain instead of snow and any stored snow will melt earlier in the year. This change is expected to reduce the Sierra Nevada spring snowpack by 70 to 80 percent (California Energy Commission 2017). As a result, imported water supply deliveries from the SWP are projected to decrease by 21 to 25 percent (Climate Change Center 2009).

Water Demand

Water demand is likely to increase with climate change. Longer drought seasons will lead to greater agricultural and landscape irrigation demands, especially for nonnative and water intensive vegetation and crops. Water demand associated with recreational activities will also increase as extreme heat days increase.

2.9.2 Identification of Vulnerabilities

Because climate change impacts vary by geography, vulnerability to climate change also varies by geography. Determining region-specific climate change vulnerabilities is the first step in assessing a Region's water resource sensitivity to climate change, effectively guiding the development of Resource Management Strategies (RMS) and identifying mitigation and adaptation strategies. The IRWMP framework convenes stakeholders with varied priorities to collaboratively develop mitigation and adaptation strategies that satisfy all water uses and needs (DWR, et al. 2011). As discussed in *Chapter 5: Projects*, IRWM Plan projects in the Fremont Basin IRWM Region are evaluated, in part, based on their ability to adapt to water-related climate impacts.

The Vulnerability Assessment Checklist contained in Appendix B of the Climate Change Handbook for Regional Water Planning was used to determine climate change impacts and vulnerabilities specific to the Fremont Basin IRWM Region. Localized data and research were used to answer the qualitative assessment. The exercise analyzed climate change impacts to water demand, water supply, water quality, sea level rise, flooding, ecosystem and habitat, and hydropower. Of the forty potential climate change vulnerabilities assessed, twenty were considered applicable to the Region. The complete Vulnerability Assessment with a description of each vulnerability and its applicability to the Region is included in Appendix E.

2.9.3 Prioritization of Vulnerabilities

The twenty Region-specific vulnerabilities identified in the Vulnerability Assessment Checklist were distilled into ten main vulnerability areas that the Region will face as climate change impacts become more apparent. During the Stakeholder Meeting held on December 14, 2017, stakeholders were asked to prioritize the ten vulnerability areas. To better inform the prioritization process, local examples were provided for each vulnerability. The prioritization results were grouped into two categories: those vulnerabilities considered to be a high priority for the Region, and those considered to be a medium priority. Vulnerabilities prioritized as "high" had the highest perceived risk and importance and included vulnerabilities related to meeting demands, reductions in groundwater supply, and increases in flooding. The RWMG aims to help address these vulnerabilities through development of the IRWM Plan, GWMP, SNMP and continued project development in the Region. All high priority vulnerabilities and most medium priority vulnerabilities, with the exclusion those associated with Ecosystem and Habitat, were discussed as feasible climate change vulnerabilities for the RWMG to address through implementation of the IRWM Plan, GWMP, and SNMP. The meeting handout with the ten vulnerability issues is included in Appendix F. Results of the prioritization exercise from the Stakeholder Meeting are summarized in **Table 2-15.** Vulnerability prioritization will be revisited with future updates to the IRWM Plan, following additional data gathering and analysis of the prioritized climate change vulnerabilities by the RWMG. The RWMG plans to gather additional data through coordination with stakeholders and State and federal government sources.

Table 2-15: Climate Change Vulnerability Issues for the Fremont Basin IRWM Region

Priority Level	Vulnerability Issue
High Priority	• **Water Demand:** Limited ability to meet future demand • **Water Supply** Decrease in groundwater supply • **Flooding:** Increase in inland flooding
Medium Priority	• **Water Demand:** Decreased ability to use groundwater storage to buffer drought • **Water Demand:** Limited ability to conserve further • **Water Demand:** Increase in crop demand • **Water Supply:** Decrease in imported supply • **Water Quality:** Increased constituent concentrations • **Ecosystem and Habitat:** Decrease in available necessary habitat • **Ecosystem and Habitat:** Increased impacts to sensitive or threatened species

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3 Water Supply and Demand Assessment

A comprehensive water supply and demand assessment can help respond to climate change, drought, land development impacts, and other factors that can threaten supply reliability. Understanding historical and projected water budget trends in the Region can help predict and prevent supply shortfalls, supporting the case for projects that can augment local water supplies. The Region utilizes a combination of water sources to meet water demand, including groundwater, imported water, and some recycled water. Supplies are used to meet urban, agricultural, and domestic water demands, and are delivered by water agencies or pumped from private wells. The following sections provide an overview of historical, current, and future projected water demand and supply sources within the Region.

3.1 Historical Water Demand

In the Region, water demands have historically been for urban and agricultural uses. Urban demand, comprised of residential, commercial, and industrial users served by the City, MPUD, Cal Water, Rancho Seco Inc., RCWD, and private pumping, has increased over time as presented in **Table 3-1**. For the purpose of this IRWM Plan, these demands include any commercial users served by the water purveyors and any associated distribution system water losses. Agricultural activities increased through the 1960s and 1970s and peaked in 1976, with groundwater extractions for agriculture reaching a maximum of approximately 60,000 AFY according to previous USGS investigations (USGS 1977). Increased groundwater production led to significant groundwater declines in the FVGB that persisted through the mid-1980's. Agricultural activities significantly decreased thereafter; when comparing cultivated acreage from USGS 1977 to 2010 aerial imagery, as of 2010, only one percent of lands cultivated in 1976 were still in production. Aerial maps were used to estimate the total area cultivated historically. It was not possible to confirm the types of crops produced in the Region based on visual inspections of aerial maps. Since alfalfa has been historically grown throughout the Region, agricultural demand estimates assume that alfalfa is the only crop cultivated in the Region for the purposes of estimating supply use only. Historical agricultural demands were estimated by applying a specific crop coefficient to the acres of land cultivated.

Historical urban water demands in the Region are based on estimated groundwater pumping data and imported water data provided by the City of California City, MPUD, and AVEK. For years with missing water records, demands were interpolated/extrapolated using:

- The population overlying the FVGB (provided by U.S. Census data)
- Historical growth rates in Kern County (provided by the Department of Finance (DOF))
- Average assumed gallons per capita per day (GPCD) for the City and MPUD (obtained from UWMPs).

Future projected water demand in the Region is presented in Section 3.2, based on population growth and potential agricultural expansion scenarios.

Table 3-1: Estimated Historical Urban and Agricultural Demand in the Region (AF)

	1960	1970	1976[1]	1980	1990	2000	2010
Agricultural Demand[2]	17,500	34,000	60,000	39,600	10,200	2,700	700
Urban Demand[3]	2,800	3,200	3,600	3,900	5,100	5,200	5,700
Total Demand	**20,300**	**37,200**	**63,600**	**43,500**	**15,300**	**7,900**	**6,400**

Sources: (1) Values for 1976 are included because it was the peak year for agricultural demands; urban demands for 1976 were interpolated from 1970 and 1980 values; (2) Estimated from Cooperative Extension University of California Division of Agriculture and Natural Resources N.D.a. and N.D.b. and aerial maps; (3) Estimated from DOF growth rates for Kern County for the years 1960 through 2010 and U.S. Census data for 1990, 2000, and 2010.
Note: Data rounded to nearest hundred.

3.2 Current and Projected Water Demand

Water demand in the Region is comprised of urban and agricultural water demands. Urban demands can be further classified into residential water uses (including commercial and water loss for the purpose of this analysis) and industrial activities. An estimated 19,400 people reside within the Region boundaries as of 2015, and the population is expected to grow more than 35 percent by 2040 (see *Section 2.8.1: Population and Demographics*), based on Kern County and the City's annual growth projections. Most population growth is expected to occur within the City and Mojave. The FVGB also supports the existing solar, mining, and manufacturing industries and an emerging cannabis industry. The solar and cannabis industries are both expected to grow significantly in the next two decades. The basin-wide water demand described in the following sections is based on demands from individual sectors, including residential, agricultural, and industrial.

Total water demand in the Region is projected to increase more than 60 percent by 2040. Residential water use accounts for the biggest portion of current demand, making up approximately 70 percent of total demand. The current per capita water use for areas served by the water purveyors in the Region is summarized in **Table 3-2**. Residential demand will continue to be the largest component of total water demand through 2040. Industrial activities account for the second largest component of current water demand, making up approximately 20 percent. In comparison, agricultural activities account for less than 10 percent of all demand. Water loss associated with water purveyor distribution systems are not separated from the residential category for the purpose of this analysis but, it is important to note, are significant issues for many distribution systems in the Region. Water demand projections in this section do not consider climate change, natural disasters, or other catastrophic or emergency events that may affect water demand. Potential impacts of climate change on demands are discussed qualitatively in *Section 2.9: Climate Change*.

Table 3-2: Water Purveyor Population, Urban Demand and Per Capita Water Use

	2015 Population Served within Service Areas	2015 Total Demand (AF)	Average per Capita Water Use (GPCD)
California City[1]	14,233	3,606	226
Cal Water[2]	189	14	66
MPUD[3]	4,200	986	210
Rancho Seco[4]	30	9	268
RCWD[5]	400	47	105
Water Purveyor Total	**19,052**	**4,662**	**-**
Regional Average	**-**	**-**	**218**

Sources: (1) California City Water Department 2017; (2) California Water Service 2016a; (3) Estimated from U.S. Census 2010; (4) Data provided by Rancho Seco on January 18, 2018; (5) SDWIS. N.D.e.
Note: Total population and water demand shown only includes that served by water purveyors. Total population in the Region is estimated at 19,400 people.

A summary of water demand by land use is provided in **Table 3-3** and described in detail in Section 3.2.1 through 3.2.3. Residential demands include water purveyor potable system demands (including commercial and water loss), recycled water demands, and the estimated unincorporated Kern County private pumping demands. For the purposes of the demand analysis, 2015 was assumed to represent current conditions. **Table 3-3** reflects a "Baseline Condition" that assumes all residential and industrial demands steadily increase according to documented planned development documented in UWMPs or cited by City planning officials, whereas agricultural demands are assumed to remain static at 2015 levels. Currently, there are no specific plans to increase or decrease agriculture in the Region, therefore the Baseline Condition represented in **Table 3-3** does not adjust agricultural demands.

Three future agricultural growth scenarios ("light", "medium", and "heavy") were developed and compared to the Baseline Condition as part of the SNMP. Though there are no formal plans to increase agriculture beyond current levels, the Baseline Condition plus the three agricultural "growth scenarios" were developed and analyzed to estimate water demands for potential growth and future agricultural activity. The agricultural growth scenarios are intended to illustrate how much additional groundwater demand would be required in the Region to support potential future agricultural growth and to inform the Region in future decisions for managing the basin sustainably. The Baseline Condition and agricultural growth scenarios are described in Section 3.2.2.

Table 3-3: Current and Projected Water Demand in the Region (AF) – Baseline Condition

	2015	2020	2025	2030	2035	2040
Residential[1]	5,278	7,339	7,686	8,045	8,408	9,328
Agricultural	647	647	647	647	647	647
Industrial	1,442	1,501	1,707	1,914	2,120	2,326
Region Total	**7,367**	**9,487**	**10,040**	**10,606**	**11,175**	**12,301**

Note: 1) Residential water demands include recycled water and unincorporated Kern County private pumping.

3.2.1 Current and Projected Residential Water Demand

A summary of the projected residential water demands is shown **Table 3-4**. The total current residential demand for 2015 in the Region is estimated to be 5,278 AFY for a total population of approximately 19,000. The water demand projections for the City are based on the 2015 UWMP and include demands for recycled water. Demands in the City service area are projected to increase by approximately 90 percent by 2040, primarily due to the planned expansion of the California City Correctional Center (California City Water Department 2017).

Table 3-4: Current and Projected Residential Water Demand (AF)

	2015	2020	2025	2030	2035	2040
California City[1]	4,124	6,125	6,386	6,650	6,917	7,743
Cal Water[2]	14	15	16	17	18	19
MPUD[2]	986	1,038	1,111	1,192	1,274	1,355
Rancho Seco[2]	9	9	10	11	12	12
RCWD[2]	47	49	53	57	61	65
Unincorporated Kern County Private Pumping[2]	98	103	110	118	126	134
Region Total	**5,278**	**7,339**	**7,686**	**8,045**	**8,408**	**9,328**

Sources: (1) Projections based on DOF growth rates for the City; (2) Projections based on DOF growth rates for the unincorporated Kern County.
Note: Water demands shown in the table above include current and projected recycled water demands.

Current and future demands for MPUD, Cal Water, RCWD, and private pumping in unincorporated Kern County were calculated by applying estimated DOF Kern County population growth rates to each agency's 2015 water deliveries in the Region (DOF 2017; California Water Service 2016). Private pumping demand in unincorporated Kern County was estimated to be 98 AF[4], based on population in the areas outside of established service areas (U.S. Census 2010) and an average per capita water use value for the Region.

3.2.2 Current and Projected Agricultural Water Demand

Historically, agricultural activities have primarily been conducted in the northern portion of the FVGB and peaked in the 1970s with estimated groundwater extractions reaching up to approximately 60,000 AFY in 1976 (USGS 1977). Agricultural activities significantly decreased thereafter; and as of 2010, only 1 percent of lands cultivated in 1976 were still in production.

Agriculture continues to be an important component of the water demand for the Region and it is anticipated to be a source of significant demand in the FVGB in the future. Though it is assumed that only alfalfa has been historically cultivated in the Region for the purposes of estimating historical demand, both the Sustainable Groundwater Management tool provided by DWR and aerial maps confirmed that pistachios are currently cultivated in the Region in addition to alfalfa. To estimate current agriculture demands, approximately 207 acres of land in the Region were assumed to be cultivated; and for the purposes of estimating current and projected future agricultural water use, it is assumed that approximately half of the area was cultivated with alfalfa and the other half of the area was cultivated with pistachios in 2015. Agricultural water demands for these two crops were estimated based on the calculated monthly gross water requirements (ETc) as the product of the reference evapotranspiration (ETo) from the Palmdale CIMIS Station and a unique crop factor (Kc). Kc values account for specific daily evapotranspiration variations due to growth and development in different crops. Calculated monthly crop evapotranspiration estimates for alfalfa and pistachios are shown in **Table 3-5.** Alfalfa has an annual gross water requirement more than eight times greater than that of pistachios, which results in a significant difference in agricultural water demand for a given acreage (**Table 3-6**) (Cooperative Extension University of California Division of Agriculture and Natural Resources N.D.a. and ND.b.). Assuming an irrigation system efficiency of 75 percent under normal conditions (USDA 2013), crop ETc is estimated at approximately 60.1 inches for alfalfa and 7.3 inches for pistachios, resulting in water demand estimates of 630 AF for alfalfa and 17 AF for pistachios in 2015. Alfalfa is a very water-intensive crop; and though it was assumed to be cultivated only on an estimated 50 percent of all farm lands in the FVGB in 2015, it accounts for more than 97 percent of the total agricultural water demand after average rainfall is taken into account.

[4] The population estimate in unincorporated Kern County is based on discussions with the Fremont Basin RWMG and their knowledge of communities outside of established service areas.

Table 3-5: Crop Evapotranspiration Estimates for the Fremont Basin IRWM Region

Month	Evapotranspiration (ETo)	Crop Factor (Kc)		Crop Evapotranspiration (ETc)	
	Cool-Season Grass[1]	Alfalfa[2]	Pistachios[3]	Alfalfa	Pistachios
January	2.3	0	0	0	0
February	3.2	0.6	0	1.9	0
March	5.0	1.1	0	5.7	0.1
April	6.5	1.0	0.3	6.3	0.6
May	8.3	1.0	0.8	8.1	1.8
June	9.2	1.0	1.1	9.4	2.5
July	9.6	1.0	0.9	10.0	1.5
August	8.7	1.0	0.4	9.0	0.8
September	6.4	1.0	0	6.1	0
October	4.5	1.0	0	4.3	0
November	2.9	0	0	0	0
December	2.1	0	0	0	0
Annual (in.)	**68.5**	**--**	**--**	**60.7**	**7.4**

Sources: (1) CIMIS. California Department of Water Resources. Data for Palmdale No. 197 Station from April 2005 through August 2017; (2) Cooperative Extension University of California Division of Agriculture and Natural Resources N.D.a; (3) Cooperative Extension University of California Division of Agriculture and Natural Resources N.D.b.

Table 3-6: Current (2015) Crop Water Requirements in the Region

	Alfalfa	Pistachios
Monthly Gross Water Requirements (in.)	60.7	7.4
Average Rainfall (in.)	5.9	5.9
Total Net Average Monthly Water Requirements (in.)	54.8	1.4
Irrigation Efficiency (%)	75%	75%
Total Water Net Usage (in.)	73.1	2.0
Total Net Water Demand (AF/acre)	6.1	0.2
Acreage (Acres)	103.5	103.5
Total Water Demand (AFY)	630	17
Total Agricultural Demand (AFY)	**647**	

To estimate future agricultural demands, a different approach was used. The viability of agricultural operations depends on several factors, including but not limited to available zoned land, the price of water, market prices for various crop types, and local community support. The Kern County General Plan zoning and descriptions were reviewed for land use designations indicated as potential for irrigated cropland. Though there are no formal plans to increase agriculture beyond 2015 levels, available documents indicate that agricultural demands in the FVGB have been as high as 60,000 AFY in the 1970s, with cultivated acreage covering a much larger area than today. To plan for potential future agricultural activity or other growth that could significantly increase water use in the Region, the Baseline Condition plus three "growth scenarios" were developed and analyzed using the historical maximum of 60,000 AFY of water demand as a basis. These "growth" scenarios are based on a percentage of the historical agricultural maximum water use; but it is important to note that actual future demands could reflect the growth of other sectors in the Region that use a significant amount of water, including industry.

The Baseline Condition assumes that 2015 demands for agriculture remain unchanged at 647 AFY in future years (about one percent of the historical maximum of 60,000 AFY). Building on the Baseline Condition, each of the three growth scenarios assumes agricultural demand in the Region would increase to approximately 5, 10, and 15 percent of the historical maximum by 2040. These are referenced as the "light growth", "medium growth", and "heavy growth" agricultural scenarios, respectively. While pistachio farming may increase in the Region due to their low water use requirements, the FVGB demand analysis was designed to assess potential future demand scenarios and is not intended to represent precise future crop profiles. Because alfalfa requires significantly more water than pistachios, the projections assume that pistachio cultivation will remain constant through 2040 and all future agricultural demand growth would be from increased alfalfa cultivation. Alfalfa cultivation is also assumed to increase linearly from 2015 to 2040. The total acres cultivated in the Region under the Baseline Condition and each of the three growth scenarios are shown in **Table 3-7.** It should be noted that other crop combinations could be cultivated and that actual agricultural demands could remain constant or decrease. It is also possible that agricultural expansion could occur more rapidly, given historical cultivation levels; but the following future scenarios are considered to be reasonable projections for the purposes of this IRWMP by the RWMG and IRWM stakeholders.

Table 3-7: Growth Scenarios - Total Area Cultivated (acres)

Scenario	2015	2020	2025	2030	2035	2040
Baseline Condition	207	207	207	207	207	207
Scenario 1: Light Growth	207	284	362	439	516	593
Scenario 2: Medium Growth	207	383	559	735	910	1,086
Scenario 3: Heavy Growth	207	481	756	1,030	1,305	1,579

Assumptions: Each of the three growth scenarios assumes linear agricultural demand increase to approximately 5, 10, and 15 percent of the historical maximum by 2040. Pistachio cultivation is assumed to remain constant through 2040, and all future agricultural demand growth is assumed to be from increased alfalfa cultivation. Projections assume an irrigation system efficiency of 75 percent under normal conditions.

Given these parameters and assumptions, alfalfa production in the FVGB has the potential to increase by approximately five times by 2040 in Scenario 1 (light growth), approximately 10 times by 2040 in

Scenario 2 (medium growth), and approximately 14 times by 2040 in Scenario 3 (heavy growth) (**Table 3-8**).

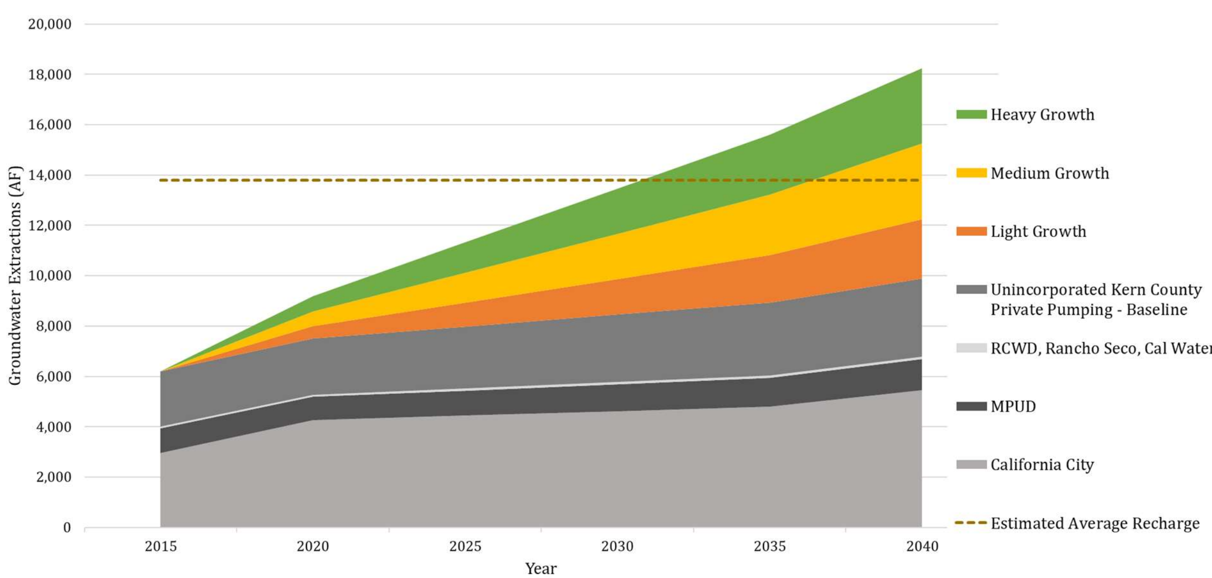
Table 3-8: Growth Scenarios - Current and Projected Water Demand in the Region (AF)

Scenario	2015	2020	2025	2030	2035	2040
Baseline Condition	647	647	647	647	647	647
Scenario 1: Light Growth	647	1,118	1,588	2,059	2,529	3,000
Scenario 2: Medium Growth	647	1,718	2,788	3,859	4,929	6,000
Scenario 3: Heavy Growth	647	2,318	3,988	5,659	7,329	9,000

Assumptions: Each of the three growth scenarios assumes linear agricultural demand increase to approximately 5, 10, and 15% of the historical maximum by 2040. Pistachio cultivation is assumed to remain constant through 2040, and all future agricultural demand growth is assumed to be from increased alfalfa cultivation. Projections assume an irrigation system efficiency of 75 percent under normal conditions.

Figure 3-1 summarizes the current and projected agricultural pumping water demands in the FVGB. Agricultural demand by 2040 is projected to be 3,000 AF for Scenario 1 (light growth), 6,000 AF for Scenario 2 (medium growth), and 9,000 AF for Scenario 3 (heavy growth). These demands are shown in comparison to the average estimated natural recharge volume for the FVGB of 13,800 AFY, as estimated in the Fremont Valley Basin GWMP. See Appendix B for additional details on the natural recharge estimate.

Figure 3-1: Groundwater Extractions in the Region – Current and Future Scenarios



3.2.3 Current and Projected Industrial Water Demand

In addition to agriculture, industrial processes are also an important component of the water demand in the Region. The four largest industrial water user categories are the solar, cannabis, mining and manufacturing industries. The cannabis industry, while traditionally thought of as an agricultural water use, is currently being regulated under the LRWQCB as an industrial water use for waste discharge requirements. Because of this, cannabis cultivation, specifically indoor cannabis cultivation, is being described in this Plan under the industrial water uses. Other types of industrial demands in the Region are assumed to be negligible, though small manufacturers may be included in future updates to the IRWM Plan. Industrial water demands are summarized in **Table 3-9**.

Table 3-9: Total Current and Projected Industrial Water Demand (AF)

	2015	2020	2025	2030	2035	2040
Solar[1]	6	6	6	6	6	6
Cannabis[2]	0	59	265	472	678	884
Mining[3]	1,105	1,105	1,105	1,105	1,105	1,105
Manufacturing[4]	331	331	331	331	331	331
Total	**1,442**	**1,501**	**1,707**	**1,914**	**2,120**	**2,326**

Sources: (1) Frisvold, G., & Marquez, T. 2013; (2) Communication with California City Staff 2018; (3) Communication with Golden Queen Mining Company Management 2018; (4) Communication with CalPortland Company management 2018.
Assumptions: Energy production, mining and manufacturing processes assumed to remain constant through 2040. Cannabis cultivation will grow to 20 facilities by 2020 and approximately 300 facilities by 2040; each facility is projected to use approximately 2.9 AFY of potable water with 70 to 80 percent wastewater reuse.

Solar Energy Production

The Beacon Photovoltaic solar plant is the largest solar facility in the Region. Water use by all other solar power plants is assumed to be negligible due to their relative sizes. Previous studies have estimated that the Beacon Photovoltaic solar plant uses an average of 6 AFY for panel cleaning (Frisvold & Marquez 2013). Demand projections assume that solar demand will remain relatively constant through 2040, as shown in **Table 3-9**.

Cannabis Cultivation

Cannabis is a new industry being developed in the Region. The City expects continued development of this industry over the next few years. The City expects to approve roughly 20 permits for 20,000 square-foot indoor cannabis grow houses by 2020 and as many as approximately 300 permits by 2040. According to the California City Public Works Director, the facilities are anticipated to operate within municipal boundaries using approximately 2.2 AFY to 2.9 AFY of potable water per facility. This water use assumes that each facility will also reuse 70 to 80 percent of its irrigation wastewater internally. Demand projections for cannabis cultivation through 2040 conservatively assume a demand of 2.9 AFY per facility (**Table 3-9**).

Mining and Manufacturing

Golden Queen Mining Company uses open pit mining methods to extract gold and silver at the Soledad Mountain Mine near Mojave. The mining operations utilize water pumped from 5 production wells and 9 domestic wells to support operations. CalPortland operates a plant in Mojave for cement production. The plant uses water pumped from a private well. Like the solar industry, water demands for mining and manufacturing are assumed to remain constant through 2040, and water use by all other manufacturing operations are assumed to be negligible. Future updates to the IRWMP may include additional demand estimates for small manufacturers pumping from the FVGB. General water demand estimates determined from communication with CalPortland Company management and Golden Queen Mining Company management are shown in **Table 3-9**.

3.3 Current and Projected Water Supplies

As described in *Chapter 2: Region Description*, water demand in the Region is met with local groundwater supplies, imported water from the SWP, and recycled water generated by the City's WWTP. Stormwater is not currently being captured for beneficial use in the Region. There are no planned stormwater capture projects at this time; therefore, stormwater was not included in the future supply analysis. The following is an analysis of the projected groundwater, imported water, and recycled water supplies in the Region through 2040 under normal conditions. The projected supplies are for an average year and do not account for climate change impacts, catastrophes, changes in legislation, and other events that can disrupt supply deliveries. Potential impacts of climate change on supplies are discussed in *Section 2.9: Climate Change*.

Total water supplied within the Region is expected to increase by approximately 180 percent by 2040 to match demand under the heavy growth scenario, as shown in **Table 3-10**. These projections assume agricultural demands will increase up to 9,000 AFY by 2040 which represents 15 percent of the historical maximum of 60,000 AFY (heavy growth scenario). The assumptions used in these projections are discussed below.

It should be noted that, assuming the average groundwater recharge value of 13,800 AFY estimated as part of the Fremont Valley Basin GWMP (Woodard & Curran 2018a), the light growth scenario is likely to be sustainable (i.e., not produce a condition of basin overdraft). The medium and heavy growth scenario, however, may not be sustainable (i.e., could produce a condition of overdraft).

Table 3-10: Total Current and Projected Water Supplies (AF)

	2015	2020	2025	2030	2035	2040
Baseline						
Groundwater	6,196	7,514	7,984	8,456	8,931	9,893
Imported Water	653	1,190	1,240	1,300	1,360	1,420
Recycled Water	518	783	816	850	884	988
Total	**7,367**	**9,487**	**10,040**	**10,606**	**11,175**	**12,301**
Scenario 1 (Light Growth): 5% of Historical Agricultural Maximum						
Groundwater	6,196	7,985	8,925	9,868	10,813	12,246
Imported Water	653	1,190	1,240	1,300	1,360	1,420
Recycled Water	518	783	816	850	884	988
Total	**7,367**	**9,958**	**10,981**	**12,018**	**13,057**	**14,654**
Scenario 2 (Medium Growth): 10% of Historical Agricultural Maximum						
Groundwater	6,196	8,585	10,125	11,668	13,213	15,246
Imported Water	653	1,190	1,240	1,300	1,360	1,420
Recycled Water	518	783	816	850	884	988
Total	**7,367**	**10,558**	**12,181**	**13,818**	**15,457**	**17,654**
Scenario 3 (Heavy Growth): 15% of Historical Agricultural Maximum						
Groundwater	6,196	9,185	11,325	13,468	15,613	18,246
Imported Water	653	1,190	1,240	1,300	1,360	1,420
Recycled Water	518	783	816	850	884	988
Total	**7,367**	**11,158**	**13,381**	**15,618**	**17,857**	**20,654**

Assumptions: For these supply/demand calculations, it is assumed that future engineered stormwater capture/recharge is negligible. The projected supplies are for an average year and do not account for climate change impacts, catastrophes, changes in legislation, and other events that can disrupt local and imported supply deliveries.

3.3.1 Groundwater

The FVGB provides the majority, if not all, of the groundwater supply within the Region. While a few wells exist in some of the surrounding groundwater basins within the Region boundaries, pumping from these wells for supply is considered minor or nonexistent, with the majority of groundwater supplies provided by the FVGB. These other groundwater basins include the Indian Wells Valley, Kelso Lander Valley, and Tehachapi Valley East groundwater basins.

Groundwater volumes pumped from the FVGB and distributed within the City for the year 2015 were documented in the City's 2015 UWMP. Because almost the entire population of the City is within the Region, all groundwater extractions occur from the FVGB and almost all are consumed within the FVGB boundary. Cal Water pumping data for the year 2015 reflects the groundwater supplies that were distributed solely to the Fremont Valley System. MPUD and RCWD provided groundwater pumping data for 2015. Demands estimated for the portions of unincorporated Kern County not served by the City, MPUD, Cal Water, Rancho Seco Inc., or RCWD are assumed to be met by groundwater pumping.

Groundwater pumping is projected to increase over the next two decades due to population growth, cannabis cultivation, and agricultural growth scenarios, as shown in **Table 3-11**. The projected groundwater pumping is assumed to be the variable for supplies and is set to be equal to the total projected demand minus projected recycled and imported water supplies. The calculations are based on the following key assumptions:

- Agricultural demands assume the Baseline Condition; light agricultural growth; medium agricultural growth, and heavy agricultural growth by 2040.
- Groundwater is the only available water supply outside of the City and MPUD service areas.
- Groundwater pumping is used to make up supply shortfalls that are not met with other sources.

Since groundwater pumping is assumed to make up supply shortfalls in this Plan, the agricultural growth scenarios would increase dependence on groundwater pumping in the Region significantly. Future plans for agricultural growth, or other growth with high water demands, in the Region should be evaluated such that the FVGB is managed sustainably in the long-term without causing overdraft conditions similar to those that the basin has experienced historically.

Table 3-11: Current and Projected Groundwater Extractions in the Region (AF)

Source	2015	2020	2025	2030	2035	2040
California City[1]	2,955	4,273	4,450	4,620	4,793	5,455
Cal Water[2]	14	15	16	17	18	19
MPUD[3]	985	918	991	1,072	1,154	1,235
Rancho Seco[4]	9	9	10	11	12	12
RCWD[5]	47	49	53	57	61	65
Baseline[a]						
Unincorporated Kern County Private Pumping[6]	2,186	2,250	2,464	2,679	2,893	3,107
Total	**6,196**	**7,514**	**7,984**	**8,456**	**8,931**	**9,893**
Scenario 1 (Light Growth): 5% of Historical Agricultural Maximum[b]						
Unincorporated Kern County Private Pumping[6]	2,186	2,721	3,405	4,091	4,775	5,460
Total	**6,196**	**7,985**	**8,925**	**9,868**	**10,813**	**12,246**
Scenario 2 (Medium Growth): 10% of Historical Agricultural Maximum[c]						
Unincorporated Kern County Private Pumping[6]	2,186	3,321	4,605	5,891	7,175	8,460
Total	**6,196**	**8,5856**	**10,125**	**11,668**	**13,213**	**15,246**
Scenario 3 (Heavy Growth): 15% of Historical Agricultural Maximum[d]						
Unincorporated Kern County Private Pumping[6]	2,186	3,921	5,805	7,691	9,575	11,460
Total	**6,196**	**9,185**	**11,325**	**13,468**	**15,613**	**18,246**

Sources: (1) California City Water Department 2017; (2) Cal Water pumping data for the Fremont Valley System; (3) MPUD pumping data; (4) Rancho Seco pumping data; (5) RCWD pumping data; (6) Estimated from supply shortfall

Note: Unincorporated Kern County Private Pumping captures private groundwater pumping for agricultural, industrial, and residential demands outside any given service area within the FVGB.

Assumptions: Projections assume that pistachio cultivation will remain constant through 2040 and all future agricultural demand growth would be from increased alfalfa cultivation; (a) 2015 demands for agriculture remain unchanged at 647 AFY in future years (about 1 percent of the historical maximum of 60,000 AFY); (b) Agricultural demand will increase to approximately 5 percent of the historical maximum by 2040; (c) Agricultural demand will increase to approximately 10 percent of the historical maximum by 2040; (d) Agricultural demand will increase to approximately 15 percent of the historical maximum by 2040.

3.3.2 Imported Water

AVEK delivers imported SWP water to both the City and MPUD. The 2015 imported water supplies and future projections for the City and MPUD were obtained from the City's and AVEK's 2015 UWMPs. The City's 2015 UWMP projects that imported water supplies will nearly double within the next two decades, whereas MPUD's imported water supplies are expected to remain constant through 2040 as shown in **Table 3-12**.

Table 3-12: Current and Projected Imported Water Supplies (AF)

	2015	2020	2025	2030	2035	2040
California City[1]	651	1,070	1,120	1,180	1,240	1,300
MPUD[2]	2	120	120	120	120	120
Total	**653**	**1,190**	**1,240**	**1,300**	**1,360**	**1,420**

Sources: (1) 2015 data from California City Water Department 2017; 2020-2040 data from AVEK 2016; (2) 2015 data from AVEK 2016; 2020-2040 projections per communication with the MPUD General Manager at the January 18, 2018 Working Group Meeting.
Assumptions: For an average water year; does not account for climate change impacts, catastrophes, changes in legislation, and other events that can disrupt imported supply deliveries.

3.3.3 Recycled Water

Recycled water generated by the City is utilized within the Region to irrigate the Tierra Del Sol Golf Course and as makeup water for Central Park Lake. Recycled water supply is projected to increase 90 percent by 2040 as shown in **Table 3-13**. As described in the City's 2015 UWMP, the increase is based on population growth that will increase potable water demand and produce higher wastewater flows to the WWTP. The City currently manages all available recycled water at eight percolation ponds, the Central Park Lake, and the Tierra Del Sol Golf Course. To increase recycled water supply and use, the City would need to expand the WWTP so that additional flows can be accepted and treated. While there are no specific plans to expand recycled water use at this time, the City is exploring the feasibility of using recycled water on green belts, parks, and other facilities, including the Par 3 Golf Course (California City Water Department 2017).

Table 3-13: Current and Projected Recycled Water Supplies (AF)

	2015	2020	2025	2030	2035	2040
Recycled Water	518	783	816	850	884	988

Source: California City Water Department 2017.

3.3.4 Water Supply Reliability in Dry Years

Water supply availability is dependent on multiple parameters, including water quality, legislation, environmental issues, catastrophes, and climatic factors. Urban water suppliers are required to develop water shortage contingency plans as part of UWMPs for supplementing or replacing the water sources in the event that water supplies are disrupted. Supply reliability can be assessed for both a single-dry and a multiple-dry year period. The following is a summary of a reliability assessment for imported water supplies and groundwater.

Imported Water Reliability

AVEK's SWP Table A allocation allows the agency to purchase up to 144,844 AFY from the SWP. Future conditions, such as climate change and drought, may alter the availability and reliability of imported water supply. The Bay Delta Conservation Plan is a collaborative effort by the federal, state, and local water agencies, environmental organizations, and other stakeholders to increase water supply reliability and restore the Delta ecosystem (DWR 2017).

The current average-year water delivery forecast of AVEK's SWP allocation (144,844 AFY) is 59 percent or 85,500 AFY. In 2014, however, SWP supply was as low as low as 8 percent of the average year deliveries. As a result, AVEK conservatively assumed 8 percent of average supply to be the worst-case scenario for a single-dry year. The multiple-dry year scenario is represented by the period between 1990 and 1992 when SWP allocations were 12 percent, 16 percent, and 24 percent, resulting in 20 percent, 27 percent, and 41 percent of AVEK's average supply available. Imported water supplies to AVEK during average, single-dry, and multiple-dry years are summarized in **Table 3-14** (AVEK 2016).

Table 3-14: AVEK Imported Water Supply Reliability

	Base Year	Percent of Average Supply Available	AF Available
Average Year	Average	100%	85,500
Single-Dry Year	2014	8%	7,200
Multiple-Dry Year: 1st Year	1990	20%	17,400
Multiple-Dry Year: 2nd Year	1991	27%	23,200
Multiple-Dry Year: 3rd Year	1992	41%	34,800

Source: AVEK 2016

Projections indicate that supply in single-dry and multiple-dry years will be insufficient to meet AVEK's water demand through 2040. AVEK supply shortages will also likely cause shortages for its customers, including California City and MPUD. To mitigate water deficiencies during multiple-dry years, AVEK developed an alternative 3-year plan for water supply that relies on groundwater extractions and banked water to meet demand. It may also implement several strategies to help water purveyors address water shortages in their service areas in the event of single-dry or multiple-dry years. Power outages, local earthquakes, aqueduct failure, and Delta levee failure are other potential catastrophes that can disrupt SWP supply. AVEK has also developed emergency contingency plans that outline activities should these events interrupt SWP supply (AVEK 2016).

To assess Regional supply reliability, it was assumed that the Region (California City and MPUD) would receive only a percentage of average year deliveries. The percentage of AVEK supply available under each climate condition shown in **Table 3-14** was applied to the Region's average year imported water supply to estimate imported water supply under single-dry and multiple-dry year conditions, as shown **Table 3-15**.

Groundwater Reliability

Because the Region relies primarily on groundwater extractions, drought conditions have minimal impacts on the Region's water supplies. The City of California City noted in their 2015 UWMP that the City has capacity to increase pumping to compensate for reductions in imported water deliveries during a single dry or multiple-dry year. Therefore, any temporary reductions in imported water in the Region are assumed to be compensated with increased groundwater pumping (California City Water Department 2017), as shown in **Table 3-15**.

This analysis assumes that the water demands for agriculture will remain unchanged at 647 AFY in future years as projected under the baseline conditions (about 1 percent of the historical maximum of 60,000 AFY), that California City and MPUD will continue to be the only SWP customers in the Region, that recycled water will only be provided by California City, and that the remaining demands will be solely met with groundwater.

Table 3-15: Fremont Basin IRWM Region Total Projected Water Supply Reliability (AF)

		2015	2020	2025	2030	2035	2040
Demand		7,367	9,487	10,040	10,606	11,175	12,301
Average Year	Imported Water	653	1,190	1,240	1,300	1,360	1,420
	Recycled Water	518	783	816	850	884	988
	Groundwater	6,197	7,514	7,984	8,456	8,931	9,893
Single Dry Year	Imported Water	52	95	99	104	109	114
	Recycled Water	518	783	816	850	884	988
	Groundwater	6,797	8,611	9,126	9,652	10,182	11,200
Multiple-Dry Years 1st Year	Imported Water	130	238	248	260	272	284
	Recycled Water	518	783	816	850	884	988
	Groundwater	6,719	8,468	8,977	9,496	10,019	11,029
Multiple-Dry Years 2nd Year	Imported Water	176	321	335	351	367	383
	Recycled Water	518	783	816	850	884	988
	Groundwater	6,673	8,385	8,890	9,405	9,924	10,930
Multiple-Dry Years 3rd Year	Imported Water	267	488	508	533	558	582
	Recycled Water	518	783	816	850	884	988
	Groundwater	6,582	8,218	8,716	9,223	9,733	10,731

4 Objectives

This chapter provides an overview of objectives and planning targets developed specifically for the Fremont Basin IRWM Region, including a description of key Regional issues, the objectives and targets development process, and the prioritization of these objectives by stakeholders. Regional objectives serve as the foundation for the development of the IRWM Plan by informing the Resource Management Strategies (RMSs) and guiding project selection and implementation to ensure that selected projects are in-line with regional needs. Quantifiable targets are identified for each objective to establish a method for tracking implementation progress.

4.1 Issues and Needs

As an arid, rural, and surface water-limited area, the Fremont Basin IRWM Region has unique water management issues. Coupled with these challenges, the Fremont Basin IRWM Region is predominately comprised of DACs; 92 percent of the land area is characterized as DAC or SDAC. The following sections detail specific issues and needs in the Region associated with water supply, water quality, flood, environmental resources, land use, and climate change. These issues were informed by the technical studies and plans used to develop the IRWM Plan as discussed in *Chapter 1: Governance and Planning*. The identified issues were then discussed and modified during Stakeholder Meetings in September and October 2017 that were focused on defining the water management needs, issues, and challenges in the Region.

4.1.1 Water Supply

Due to the lack of surface water supplies in the Region, groundwater and imported water meet the majority of demands and will continue to do so. While the FVGB has historically been able to provide sufficient supply to meet demand, there is a limited understanding of storage and withdrawal capacity in the basin. Groundwater modeling and analyses for the basin are limited and, because the basin is not adjudicated, pumping is not currently managed by a Watermaster. The FVGB is also located near neighboring groundwater basins that are experiencing overdraft, like the Antelope Valley Groundwater Basin and the Indian Wells Valley Groundwater Basin (DWR 2014a; DWR 2004e). Some stakeholders in the Region have expressed concerns about efforts by others to export groundwater from the FVGB. With projected increases in demand from new development and new land uses such as cannabis cultivation and solar energy, sustainable management of the FVGB is important for continued regional supply reliability.

The Region is also partly dependent on imported water for supply. Imported water from the SWP experiences annual variability, particularly during droughts, and is susceptible to climate change, natural disasters, and catastrophic events. Additionally, imported water supplies can experience temporary interruptions, requiring the use of alternative supplies and stored water.

In addition to these potential supply issues, local water distribution systems in the Region are vulnerable to damage during seismic events. Several pipelines that transport water from wells to end users cross large fault zones, such as the Garlock Fault. These systems also often depend on a single pipeline, connection or well, further decreasing the reliability of the supply.

4.1.2 Water Quality

As discussed in *Chapter 2: Region Description*, groundwater quality is generally good within most parts of the Fremont Basin IRWM Region and is influenced by historic and existing land use practices, water extractions, industrial discharges, urban and agricultural runoff, and natural conditions. Preventing degradation of the groundwater quality is critically important to the Region. The FVGB, which meets the majority of the water demands in the Region, contains some areas with high arsenic, nitrate, and hexavalent chromium concentrations as described in *Section 2.4.2: Groundwater Quality*. While drinking water quality standards are still mostly achieved in these areas, exceedances have led to the shut down of some wells; changing regulations could result in additional exceedances (i.e., for hexavalent chromium) and could create the need to provide wellhead treatment or shut down additional wells. Imported water quality generally meets federal primary and secondary drinking water standards (AVEK 2016). Effective management of the specific water quality challenges of the Fremont Basin IRWM Region is critical to the long-term sustainability of the Region.

4.1.3 Flood

Stormwater flows from large storm events pose a number of serious issues for the Region. Some areas of the Region are at high risk for flooding, which is difficult to mitigate against when there is a high degree of aging or failing infrastructure. For example, this issue is of particular concern around Cache Creek and in the Cantil area where high flows from Jawbone Canyon endanger the railroad berm. Impervious surfaces that divert flows and seasonal drainages from surrounding creeks further intensify flood hazards in the Region. Despite these known challenges, there are few studies and evaluations completed on flood-prone areas (Stetson 2009). Climate change will also affect the frequency, duration, and intensity of flooding, as rapid snowmelt and intense rains are expected to result in extreme, high-flow events in the Region (California Emergency Management & Natural Resources Agency 2012). Another challenge faced by the Region is that flood waters typically flow to the dry lake bed, Koehn Lake, where they evaporate on the valley floor. Implementing projects that would beneficially reuse those flood flows would require new infrastructure to bring the flows from their origin to a place of beneficial use, such as for groundwater recharge.

Flood damage from the 1983 flood event in the Region

4.1.4 Habitat and Open Space

The Fremont Basin IRWM Region provides critical habitat for several species of special concern, including the desert tortoise, Mohave ground squirrel, and the burrowing owl. Limited wetted areas in the Region also provide critical habitats for migratory birds, making the Region an important component of the Pacific Flyway. These species are threatened by habitat loss and land degradation as urban areas expand and populations grow. Invasive species, which threaten the native ecosystem, are also a growing concern in the area as the climate changes. Successfully balancing the needs of the

Region's environmental resources with the needs of the Region's communities is critical to the health and integrity of the entire Region.

4.1.5 Land Use

Solar panels in the Region

While the majority of the Region consists of open space and habitat for the Region's desert flora and fauna, there are also areas of urban, agricultural, and industrial land use. Alfalfa and pistachios are grown in unincorporated areas of the Region, and indoor cannabis cultivation and sale in California City is expected to become a key component of the Region's economy. Solar power generation has also become a booming industry. The Region's population is expected to grow by approximately 40 percent by 2040. These diverse land uses cause challenges for managing the Region's water resources. As urban areas continue to expand, stresses on the local groundwater supply will increase. New and expanded land uses can also impact the location and extent of the potential contamination associated with these activities, posing new water quality issues for the Region. Flooding issues may also increase as the amount of urban, impervious area increases. As development continues in the Region, urban, industrial, and other land uses will encroach on spaces used for habitat or agriculture. Effective land management in the Region will balance these interests and create a land use framework for the benefits and issues associated with varying land uses. Promoting integrated land use planning concepts is essential for water resource managers in the Region.

4.1.6 Climate Change

Anthropogenic GHG emissions change the composition of Earth's atmosphere, altering Earth's energy balance and climate as a result. Because the Region is landlocked, rising sea levels are not an immediate concern, but sea level rise is expected to impact imported water supplies in the Delta that ultimately influence the Region. Locally, climate change will have profound impacts including rising temperatures (6 to 11°F increase), reduced SWP deliveries (21 to 25 percent reduction), and decreased rainfall (1 to 10-inch decrease) by 2100 (California Emergency Management & Natural Resources Agency 2012; Climate Change Center 2009). Increased temperatures combined with decreased rainfall could increase water demands in an already water-limited Region. Projections also indicate a rise in the likelihood of severe weather events, which will contribute to more intense flooding in the Region. Climate change could also negatively alter the current ecology of the Region, displacing the native flora and fauna with nonnative species that thrive in the new climate. Decreased precipitation will limit groundwater recharge and contribute to declining groundwater levels, making the basins even more susceptible to overdraft. Imported water supplies are particularly vulnerable to climate change, and reductions in SWP deliveries will require water purveyors to secure alternate sources of water. Addressing climate change impacts requires a twofold strategy that incorporates both mitigation and adaptation activities.

4.2 Objectives Development

IRWM planning recognizes that regional stakeholders are best positioned to understand the unique water management issues facing the Region. This process allows for more tailored management of regional water resources issues and development of strategic objectives. With a direct understanding of the issues, stakeholders can develop objectives that are regionally specific.

Identifying Regional issues and objectives during the September 21, 2017 Stakeholder Meeting at Jawbone Station Visitors Center in Cantil, CA

Objectives and targets development for the Fremont Basin IRWM Region was a collaborative process that incorporated input from all participating stakeholders. Existing and future water resources management issues in the Region were identified during the September 2017 Stakeholder Meeting. With an established list of regional water management issues, the RWMG drafted Regional objectives and initial planning targets. The draft objectives and targets were discussed and further refined in subsequent stakeholder and working group meetings in 2017. During these discussions, the stakeholders considered previously identified regional needs, the 2016 IRWM Grant Program Guidelines, and Water Code §10540(c) and §10541 requirements related to IRWMPs.

The RWMG and stakeholder group decided that identifying objectives with specific planning targets was the best way to represent the needs of the Region. Overall goals were not developed as an additional layer; instead objectives were grouped into categories including: Water Supply, Water Quality, Flood Management, Habitat and Open Space, Land Use, and Climate Change. Each objective has at least one planning target to help set realistic, measurable expectations and monitor progress toward meeting the objective. Each target delineates either qualitative or quantitative metrics, depending on which is most appropriate for the given objective, to track progress. It was also decided that because the Region is almost entirely DAC (92 percent), a separate objective to address DAC issues was not necessary and all objectives for the Region would contribute to addressing these issues.

Regional stakeholders agreed on the final list of objectives during Stakeholder Meeting #8 on November 16, 2017, as documented in the Stakeholder Meeting notes posted on the City of California City's Fremont Basin IRWM website. These objectives and planning targets are summarized in **Table 4-1** and are discussed further in *Section 4.3: Objectives and Planning Targets* below.

Table 4-1: Summary of Fremont Basin IRWM Region Objectives and Targets

Objective	Target
Water Supply	
Increase regional water supply reliability to meet demands	Increase recycled water use by 2025 compared to 2017
	Increase stormwater capture by 2025 compared to 2017
	Provide adequate supply reserves for single-dry (1,300 AFY) and multi-dry (3,000 AF over 3 years) years
	Maintain conservation programs
	Identify infrastructure at risk of being compromised by 2020
	Adapt to climate change impacts on runoff and recharge, and from sea level rise
Ensure sustainable use of the Fremont Valley Groundwater Basin	Begin developing a GSA and GSP for the Fremont Valley Groundwater Basin by 2019
	Define the safe yield of the Fremont Valley Groundwater Basin by 2027
	Manage the Fremont Valley Groundwater Basin such that the 10-year average change in groundwater levels is zero.
Water Quality	
Provide drinking water that meets regulatory requirements and customer needs	Meet federal and State water quality standards as well as customer standards for taste and aesthetics on an ongoing basis
Protect water quality in groundwater basins in the Region	Prevent degradation of groundwater basins with respect to Basin Plan objectives
	Map contaminant sites and movement in the Fremont Valley Groundwater Basin by 2027
Flood Management	
Reduce negative impacts of stormwater	Identify areas of highest flood risk in the Region by 2018
	Implement projects to provide flood protection to existing and future planned properties where benefits exceed costs
	Implement integrated, multi-benefit flood management projects, when feasible

Objective	Target
Habitat and Open Space	
Support water needs of open space/recreational/migratory habitat areas	Maintain multi-benefit use of Central Park Lake and other water habitat for species
Support protected habitats	Support existing protected habitats including the Fremont Valley Ecological Reserve
Land Use	
Maintain agricultural land uses	Support limited agricultural land uses
Improve integrated land use planning to support water management	Positive participation of Kern County and other stakeholders at public meetings; increased correspondence
Climate Change	
Mitigate against climate change	Implement mitigation strategies, when possible, that reduce energy consumption, ultimately reducing GHGs
	Support carbon sequestration and using renewable energy, when possible, to support Regional objectives
	Consider strategies adopted by CARB in its AB 32 Scoping Plan when developing projects to meet objectives

4.3 Objectives and Planning Targets

As a result of the collaborative stakeholder-driven process, the Fremont Basin IRWM Region has a total of 10 objectives with 22 planning targets. The objectives, described below, are organized by the six overarching Regional issue categories: water supply, water quality, flood management, habitat and open space, land use, and climate change. Targets for each objective are also identified, which will allow the Region to monitor progress on each objective.

Because nearly the entire Region is characterized as DAC, all Regional objectives would help address DAC issues and needs; thus, a specific DAC objective is not included.

4.3.1 Water Supply

Two strategic water supply management objectives and corresponding planning targets were developed in accordance with Water Code requirements, IRWM Guidelines, and the following key regional water supply issues:

- The FVGB meets the majority of demands in the Region
- Some surrounding basins are in critical overdraft
- The Region's local water distribution systems are vulnerable given the number of fault zones and potential for seismic events
- There is limited understanding of storage and withdrawal capacity in the FVGB
- There is a projected increase in regional water demands from new development and land uses
- The Region is partly dependent on imported water, a supply that has annual variability and is susceptible to interruptions

Objective: Increase regional water supply reliability to meet demands

California City water infrastructure

Providing reliable supplies means that an expected amount of groundwater, recycled water, and imported water will be continuously delivered to the Region to meet demands. Deliveries depend on the availability of water from the source, the conditions of existing infrastructure necessary for water conveyance, and the regional demands. As discussed in *Chapter 3: Water Demand and Supply Assessment*, the demand of the Fremont Basin IRWM Region was approximately 7,400 AF in 2015. The estimated water supply from imported, recycled and groundwater sources to the Region was approximately 7,400 AF in 2015, effectively meeting the demand. Climate change, however, is expected to alter precipitation, increase water demands, and decrease imported water supply in the Region as discussed in *Section 2.9.1: Climate Change Impacts on the Region* (California Emergency Management & Natural Resources

Agency 2012; Climate Change Center 2009). Furthermore, conveyance delivery systems, which are needed to transport groundwater and imported water in the Region, are vulnerable to earthquakes. By increasing regional reliability, the Region can reduce the likelihood that deliveries will be affected by climate change, drought, and other catastrophes. This objective will help increase regional water supply reliability by increasing recycled water use and stormwater capture, maintaining conservation programs, adapting to climate change impacts, identifying at-risk infrastructure, and planning for single dry and multiple dry years. Additionally, by increasing local supplies such as recycled water and stormwater capture for recharge of the groundwater supplies, the Region will be less dependent on imported water supplies from the Delta.

Targets

- Increase recycled water use by 2025 compared to 2017
- Increase stormwater capture by 2025 compared to 2017
- Provide adequate supply reserves for single dry (1,300 AFY) and multi-dry (3,000 AF over 3 years) years
- Maintain conservation programs
- Identify infrastructure at risk of being compromised by 2020
- Adapt to climate change impacts on runoff and recharge, and from sea level rise

Objective: Ensure sustainable use of the Fremont Valley Groundwater Basin.

Because of the annual variability of imported water sources, future supply projections assume that groundwater supply will compensate for any imported and recycled water supply shortfalls in the Region. To prevent critical overdraft of the FVGB, groundwater recharge (natural and engineered) must counter extraction volumes. This objective will help ensure sustainable use of the FVGB by supporting compliance with SGMA, defining safe yield for the basin, and ensuring that the 10-year average change in groundwater basin levels is zero.

Targets

- Begin developing a GSA and GSP for the FVGB by 2019
- Define the safe yield of the Fremont Valley Groundwater Basin by 2027
- Manage the FVGB such that the 10-year average change in groundwater levels is zero

4.3.2 Water Quality

Two water quality management objectives and planning targets were developed in accordance with Water Code requirements, IRWM Guidelines, and to address the following key regional water quality issues:

- There are some water quality constituent concentration exceedances in parts of the FVGB
- Recent (and potential future) regulatory changes related to concentration limits for hexavalent chromium

Objective: Provide drinking water that meets regulatory requirements and customer needs.

Imported water and groundwater are the only two water supply sources used to meet potable demands. As previously discussed, DWR monitors SWP water quality and ensures that deliveries comply with federal drinking water standards (DWR N.D.b.). The Tehachapi District from DWR's Division of Drinking Water Program regulates all water purveyors in the Region and ensures that the public drinking water systems meet federal primary and secondary drinking water standards. As such, the identified regional target promotes meeting federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period. This objective will help the Region meet federal and State water quality standards.

Targets

- Meet federal and State water quality standards as well as customer standards for taste and aesthetics on an ongoing basis

Objective: Protect water quality in groundwater basins in the Region.

A wide range of groundwater contaminants have been identified in most basins in the Region. The FVGB meets the majority of the demands in the Region and contains variable mixtures of sodium, calcium, chloride, sulfate, and bicarbonate, with TDS concentrations ranging from 350 to over 1,000 mg/L. Several other basins in the Region show elevated levels of arsenic, lead, nitrate, sodium, fluoride, boron, and TDS. This objective will protect water quality in all Regional groundwater basins by preventing degradation of the basins and focusing on mapping contaminant sites and movement in the FVGB, the primary source of water supply in the Region.

Targets

- Prevent degradation of groundwater basins with respect to Basin Plan objectives
- Map contaminant sites and movement in the Fremont Valley Groundwater Basin by 2027

4.3.3 Flood Management

A flood management objective was developed in accordance with Water Code requirements, IRWM Guidelines, and to address the following key regional flooding issues:

- Some areas of the Region are at high risk for flooding during severe storms
- Some areas in the Region have aging or failing stormwater and flood infrastructure
- There is a potential for beneficial reuse of stormwater for recharge

Flood damage near the railroad tracks during the 1983 flood event

Objective: Reduce negative impacts of stormwater.

Proper stormwater management offers numerous benefits. In addition to mitigating floods caused by large storm events, proper management and implementation of stormwater capture projects can also generate a local water supply. Reduction of negative stormwater impacts will be achieved by first identifying areas of highest flood risk in the Region and implementing projects to provide flood protection. This objective will help reduce the negative impacts of stormwater by identifying the highest flood risk areas and implementing projects to provide flood protection.

Targets

- Identify areas of highest flood risk in the Region by 2018
- Implement projects to provide flood protection to existing and future planned properties where benefits exceed costs
- Implement integrated, multi-benefit flood management projects, when feasible

4.3.4 Habitat and Open Space

Two habitat and open space objectives were developed in accordance with Water Code requirements, IRWM Guidelines, and to address the following key regional habitat and open space issues:

- The Region includes numerous protected habitats and open space areas used for recreation
- The Region is a critical part of the Pacific Flyway and the limited wetted areas in the Region provide habitat for birds

Central Park Lake in California City

Objective: Support water needs of open space/recreational/migratory habitat areas.

Because the Region is surface-water limited, protection of any existing surface water bodies, whether seasonal or perennial, is critical for the health of local habitat and ecosystems. This objective will support the water needs of open space/recreational/migratory habitat areas by maintaining Central Park Lake and other water habitats for species.

Target

- Maintain multi-benefit use of Central Park Lake and other water habitat for species

Objective: Support protected habitats.

The Fremont Basin IRWM Region is home to protected habitat for critical species, including the desert tortoise. Supporting protected habitats is key for safeguarding the health of flora and fauna that depend on those habitats for survival. This objective will support protected habitats by supporting areas such as the Fremont Valley Ecological Reserve.

Target

- Support existing protected habitats including the Fremont Valley Ecological Reserve

4.3.5 Land Use

Two land use objectives were developed in accordance with Water Code requirements, IRWM Guidelines, and to address the following key regional land use issue:

- The Region includes agricultural, energy, and other land uses that contribute to the overall economy

Objective: Maintain agricultural land uses.

Alfalfa and pistachios are grown in approximately 207 acres of farmland with an annual water demand of 647 AF. Baseline projections assume that agricultural land use and water demand will remain constant through 2040, though water demands may increase as climate change decreases annual precipitation in the Region. Additionally, agricultural land use could increase in the future as described in *Chapter 3: Supply and Demand Assessment*. This objective will support existing agriculture in the Region.

Target

- Support limited agricultural uses

Objective: Improve integrated land use planning to support water management.

A successful IRWM Plan requires coordination between land use planning agencies and water management agencies. Collaboration ensures all current and future water demands are met with respect to projected land use changes, land development, and population growth in the Region. Land use planning agencies working directly with water management agencies can more effectively address regional needs such as land, energy, and water supply deficiencies. Integrated planning allows agencies to cooperate with the infrastructure development and improvements necessary for sustaining regional growth. Most importantly, natural and economic resources are more sustainably managed under integrated land use planning. This objective will support improved integrated land use planning and water management by increasing correspondence with and positive participation of Kern County and other stakeholders at public meetings.

Target

- Positive participation of Kern County and other stakeholders at public meetings; increase correspondence

4.3.6 Climate Change

One climate change objective was developed in accordance with Water Code requirements, IRWM Guidelines, and to address the following key Regional climate change issue:

- The Region will implement projects that may contribute to the overall carbon footprint

It should be noted that the Fremont Basin IRWMP contains two objectives related to climate change. The first covers adaptation and is included under the water supply Regional objectives. The second covers mitigation and is include here, under the climate change Regional objective.

Objective: Mitigate against climate change.

For the purposes of this Plan, mitigating against climate change means reducing or abating activities that may accelerate climate change impacts. Implementing regional projects may contribute to the overall carbon footprint by releasing GHGs through construction activities. Because GHG emissions are directly correlated with climate change, this objective will help implement mitigation strategies, when possible, that decrease GHGs or are GHG neutral. This objective will help mitigate against climate change by supporting carbon sequestration and renewable energy use and considering strategies identified in the Assembly Bill (AB) 32 scoping plan when developing projects.

Targets

- Implement mitigation strategies, when feasible, that reduce energy consumption, ultimately reducing GHGs
- Support carbon sequestration and using renewable energy, when feasible, to support Regional objectives
- Consider strategies adopted by CARB in its AB 32 Scoping Plan when developing projects to meet objectives

4.4 Objective Prioritization

The Regional objectives were reviewed and prioritized during the December 14, 2018 working group meeting. As part of the meeting, stakeholders discussed the objectives they felt were a higher priority for the Region. Handouts listing the Regional objectives and targets were distributed to the working group attendees. The working group was asked to rank the objectives as a high or medium priority for the Region using the handouts. The group agreed that the highest priority for the Region is protecting the FVGB. Most stakeholders felt the water supply and water quality objectives were the highest priority. The prioritized objectives are summarized in **Table 4-2**.

Table 4-2: Prioritized Regional Objectives

Objective	Priority Level
Water Supply	
Increase regional water supply reliability to meet demands	Highest Priority
Ensure sustainable use of the Fremont Valley Groundwater Basin	Highest Priority
Water Quality	
Provide drinking water that meets regulatory requirements and customer needs	Highest Priority
Protect water quality in groundwater basins in the Region	Highest Priority
Flood Management	
Reduce negative impacts of stormwater	Priority
Habitat and Open Space	
Support water needs of open space/recreational/migratory habitat areas	Priority
Support protected habitats	Priority
Land Use	
Maintain agricultural land uses	Priority
Improve integrated land use planning to support water management	Priority
Climate Change	
Mitigate against climate change	Priority

4.5 Plan Objectives and Statewide Priorities

In addition to meeting the regional issues and needs identified in *Section 4.1: Issues and Needs*, the adopted objectives are also in compliance with the Statewide Priorities endorsed by DWR. The following section defines the Statewide Priorities contained in the 2016 IRWM Guidelines and describes how the objectives address these Priorities.

4.5.1 Statewide Priorities

DWR compiled ten Statewide Priorities based on the 2014 California Water Action Plan to promote holistic water management throughout California. The Statewide Priorities incorporate all aspects of water resources management, ranging from water conservation to flood protection. Key actions were highlighted to help meet each of the Statewide Priorities, summarized in **Table 4-3**. The Fremont Basin IRWM Plan addresses 9 of the Statewide Priorities; the last Priority aimed to "identify sustainable and integrated financing opportunities" is not relevant as it only applies to state agencies and legislature.

4.5.2 Objective Compliance with Statewide Priorities

The Statewide Priorities served as a guiding tool for developing Regional objectives. As a result, the adopted objectives address not only regional issues but also statewide needs. **Table 4-4** summarizes how the ten Fremont Basin IRWM Plan objectives support the Statewide Priorities.

Table 4-3: Statewide Priorities

Statewide Priority	Regional Action	Included in IRWM Plan
Make Conservation a California Way of Life	• Build on current water conservation efforts • Expand agricultural and urban water conservation and efficiency • Provide funding for conservation and efficiency • Increase water sector energy efficiency and GHG reduction capacity • Promote local urban conservation ordinances and programs	Yes
Increase Regional Self-Reliance and Integrated Water Management Across All Levels of Government	• Ensure water security at the local level • Support and expand funding for Integrated Water Management planning and projects • Improve land use and water alignment • Provide assistance to DAC • Focus on projects with multiple benefits • Increase recycled water use	Yes
Achieve the Co-Equal Goals for the Delta	• Support projects that provide a more reliable water supply for CA • Support projects that protect, restore, and enhance the Delta ecosystem	Yes

Statewide Priority	Regional Action	Included in IRWM Plan
Protect and Restore Important Ecosystems	• Protect and restore the resiliency of ecosystems • Manage headwaters for multiple benefits • Water for wetlands and waterfowl • Enhance water flows in stream systems statewide	Yes
Manage and Prepare for Dry Periods	• Secure more reliable water supplies and improve drought preparedness • Revise operations to respond to extreme conditions • Encourage healthy soils	Yes
Expand Water Storage Capacity and Improve Groundwater Management	• Increase water storage for public and environmental benefits • Provide essential data to enable Sustainable Groundwater Management • Support funding partnerships for storage projects • Improve Sustainable Groundwater Management • Support distributed groundwater storage and recharge • Accelerate clean-up of contaminated groundwater and prevent future contamination	Yes
Provide Safe Water for All Communities	• Provide all Californians with safe, clean, affordable, and accessible water • Consolidate water quality programs • Provide funding assistance for vulnerable communities • Manage the supply status of community water systems • Include projects that help address the impacts caused by nitrate, arsenic, perchlorate, or hexavalent chromium contamination	Yes
Increase Flood Protection	• Plan for integrated flood and water management systems • Implement flood projects that protect public safety, increase water supply reliability, conserve farmlands, and restore ecosystems • Improve access to emergency funds • Better coordinate flood response operations • Prioritize funding to reduce flood risk and improve flood response • Encourage flood projects that plan for climate change and achieve multiple benefits	Yes
Increase Operational and Regulatory Efficiency	• Encourage local or regional projects that support increased operational efficiency of the SWP	Yes
Identify Sustainable and Integrated Financing Opportunities	• Directed towards State agencies and the legislature	No

Source: DWR 2016

Table 4-4: Conformance of Objectives with Statewide Priorities

IRWM Plan Objectives	Statewide Priority								
	Make Conservation a Way of Life	Increase Regional Self-Reliance and Integrated Water Management	Achieve the Co-Equal Goals for the Delta	Protect and Restore Important Ecosystems	Manage and Prepare for Dry Periods	Expand Water Storage Capacity and Improve Groundwater Management	Provide Safe Water for all Communities	Increase Flood Protection	Increase Operational and Regulatory Efficiency
Increase regional water supply reliability to meet demands	●	●	●		●	●	●	●	●
Ensure sustainable use of the Fremont Valley Groundwater Basin	○	●	○		○	●	●		
Provide drinking water that meets regulatory requirements and customer needs						●	●		●
Protect water quality in groundwater basins in Region				○	○	●	●		
Reduce negative impacts of stormwater		●						●	
Support water needs of open space/recreational/migratory habitat areas				●					
Support protected habitats				●					
Maintain agricultural land uses	●	○			●				
Improve integrated land use planning to support water management	○	●	○	●	○	○	●	○	●
Mitigate against climate change	●	○	○	○	○	○	○	○	●

Note: ● IRWM Plan objective directly supports the listed Statewide Priority; ○ IRWM Plan objective indirectly supports the listed Statewide Priority

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5 Resource Management Strategies

In 2013, the State of California prepared the California Water Plan Update 2013 (CWP 2013 Update). Designed to work in tandem with, and help implement, the Governor's Water Action Plan, the CWP 2013 Update includes strategies to: reduce water demand, increase water supply, improve water quality, practice resource stewardship, improve flood management, and recognize people's relationship to water. The CWP 2013 Update also includes other, emerging strategies that could potentially generate benefits to meet one or more water management objectives.

Known as resource management strategies (RMSs), these strategies are techniques, programs, or policies that help local agencies and governments manage their water and water-related resources. The 36 RMSs identified in the CWP 2013 Update are organized alphabetically under eight categories, which describe their primary objectives and emphases. The combination of strategies applicable to a particular IRWM region will vary, depending on climate, projected growth, existing water systems, environmental and social conditions, and regional goals. This chapter highlights the RMSs that are considered appropriate and valuable for the Fremont Basin IRWM Region.

5.1 Consideration of Resource Management Strategies

The new and continuing challenges of the Region's conditions require new and varied methods of managing water. Integrated water management relies on a diversified portfolio of water strategies to achieve multiple and sustainable uses and benefits while balancing the risks of an uncertain future. Adapting to and mitigating climate change impacts have become increasingly important factors in selecting and implementing a package of management strategies. To determine the strategies appropriate to the Fremont Basin IRWM Region, stakeholders considered the 36 RMSs described in the CWP 2013 Update during the November 2017 Stakeholder Meeting.

After discussing the strategies, the Region's stakeholders came to a consensus on whether each strategy was appropriate for the Fremont Basin IRWM Region. **Table 5-1** provides a brief description of the 36 RMSs considered for the IRWM Plan and details which management strategies were decided to be appropriate for the Region.

5.2 Objectives Assessment

Once the RWMG and Fremont Basin IRWM stakeholder group developed the Regional objectives and identified regionally-appropriate RMSs, an assessment was performed to determine how the regional strategies aligned with the chosen objectives. The assessment, provided in **Table 5-2** below, illustrates how each of the Regional objectives can be address by multiple RMSs and how a single RMS can address multiple Regional objectives.

Table 5-1: Resource Management Strategies in the Fremont Basin IRWM Region

Resource Management Strategy	Summary Description	Appropriate for the IRWM Region?
Reduce Water Demand		
Agricultural Water Use Efficiency	Using and applying scientific processes to control agricultural water delivery and use to achieve a beneficial outcome	✓
Urban Water Use Efficiency	Implementing activities that reduce urban water use by increasing water use efficiency	✓
Improve Operational Efficiency and Transfers		
Conveyance – Delta	Upgrading Delta conveyance structures to improve water supply reliability and distribution, provide greater operational flexibility, and improve ecosystem function	✓
Conveyance – Regional/Local	Implementing activities to improve regional and local conveyance structures including natural watercourses and human-made facilities like canals, pipelines, and flood bypasses	✓
System Reoperation	Changing existing operation and management with the goal of increasing desired benefits from the system	✓
Water Transfers	Temporary or long-term changes in the point of diversion, place of use, or purpose of use due to a transfer, sale, lease, or exchange of water or water rights	✓
Increase Water Supply		
Conjunctive Management and Groundwater Storage	Coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies to meet various management objectives	✓
Desalination (Brackish and Sea Water)	Removal of salts from saline water – can include sea water or brackish groundwater	✓
Precipitation Enhancement	Artificially stimulating clouds to produce more rainfall or snowfall than they would produce naturally	
Municipal Recycled Water	Treating municipal wastewater to a specified quality that enables it to be used again	✓
Surface Storage – CALFED/State	Surface storage (human-made, above-ground reservoirs) located at one of the locations recommended as part of the CALFED Bay-Delta Program	
Surface Storage – Regional/Local	Regional and local surface storage options aside from those included in the Surface Storage – CALFED/State RMS	✓

Resource Management Strategy	Summary Description	Appropriate for the IRWM Region?
Improve Water Quality		
Drinking Water Treatment and Distribution	Development and maintenance of adequate water treatment and distribution facilities to provide reliable, high-quality, and safe water for human consumption	✓
Groundwater/Aquifer Remediation	Improving the quality of degraded groundwater for beneficial use by removing constituents that affect its beneficial use	✓
Matching Water Quality to Use	Recognizing that not all water uses require the same water quality	✓
Pollution Prevention	Reducing or eliminating waste at the source by modifying production processes, promoting the use of non-toxic or less toxic substances, reducing the generation and/or discharge of the pollutants, and preventing pollutants from entering the environment prior to treatment	✓
Salt and Salinity Management	Reducing salt loads that impact a region	✓
Urban Runoff Management	Managing stormwater and dry-weather runoff by reducing pollutant loading and the volumes and velocities or urban runoff discharged to surface waters	✓
Improve Flood Management		
Flood Management	Implementing activities that help manage floodwaters, including structural, nonstructural, restoration of natural floodplain functions, and flood emergency management approaches	✓
Practice Resources Stewardship		
Agricultural Lands Stewardship	Implementing activities that conserve and improve land for food, fiber, biofuel production, watershed functions, and soil, air, energy, plants, animals, and other conservation purposes with a primary focus on private land in agriculture including cultivated land and rangeland	✓
Ecosystem Restoration	Improving the condition of modified natural landscapes and biological communities to provide for their sustainability and for their use and enjoyment by current and future generations	✓
Forest Management	Implementing activities, on both public and privately-owned forest lands, whose goals specifically include improvement of the availability and quality of water for downstream users	
Land Use Planning and Management	Planning for the housing and economic development needs of a growing population, while providing for the efficient use of water, water quality, energy, and other resources	✓
Recharge Areas Protection	Implementing activities that ensure areas suitable for recharge continue to be capable of adequate recharge and prevent pollutants from entering the groundwater to avoid expensive treatment that may be necessary prior to beneficial use	✓

Resource Management Strategy	Summary Description	Appropriate for the IRWM Region?
Sediment Management	Implementing activities that address excessive sediment in watersheds	✓
Watershed Management	Creating and implementing plans, programs, projects, and activities to restore, sustain, and enhance watershed functions	✓
People and Water		
Economic Incentives Policy	Offering financial assistance, water pricing, and water market policies intended to influence water management	✓
Outreach and Engagement	Using tools and practices to facilitate contributions by public individuals and groups toward good water management outcomes	✓
Water and Culture	Recognizing the importance of linking cultural considerations to water management	✓
Water-Dependent Recreation	Implementing activities that ensure that the public can enjoy water-dependent recreation activities	✓
Other Strategies		
Crop Idling for Water Transfers	Removing lands from irrigation with the aim of returning the lands to irrigation at a later time	
Dewvaporation or Atmospheric Pressure Desalination	Evaporating brackish water by heated air, which deposits fresh water as dew on the opposite side of a heat transfer wall	
Fog Collection	Installing physical structures or nets to collect precipitation present in fog	
Irrigated Land Retirement	Removing farmland from irrigated agriculture	
Rainfed Agriculture	Directly providing crop consumptive water use by rainfall in real time	
Snow Fences	Installing fencing to strengthen forest and watershed management, protect sensitive environments, and facilitate slower snowmelt to extend runoff into the summer	
Waterbag Transport/Storage Technology	Diverting water in areas that have unallocated freshwater supplies, storing the water in large inflatable bladders, and towing them on the ocean to be used in other areas	

Table 5-2: Regional Objectives Compared to Region-Appropriate Resource Management Strategies

Resource Management Strategy	Water Supply		Water Quality		Flood Management	Habitat and Open Space		Land Use		Climate Change
	Increase regional water supply reliability to meet demands	Ensure sustainable use of the Fremont Valley Groundwater Basin	Provide drinking water that meets regulatory requirements and customer needs	Protect water quality in groundwater basins in Region	Reduce negative impacts of stormwater	Support water needs of open space/ recreational/ migratory habitat areas	Support protected habitats	Maintain agricultural land uses	Improve integrated land use planning to support water management	Mitigate against climate change
Reduce Water Demand										
Agricultural Water Use Efficiency	X	X		X				X	X	X
Urban Water Use Efficiency	X	X							X	X
Improve Operational Efficiency and Transfers										
Conveyance – Delta	X		X					X	X	X
Conveyance – Regional/Local	X		X		X			X	X	X
System Reoperation	X		X		X			X	X	X
Water Transfers	X	X	X					X	X	X
Increase Water Supply										
Conjunctive Management and Groundwater Storage	X	X		X	X				X	X
Desalination (Brackish)	X	X	X	X					X	X
Municipal Recycled Water	X	X				X			X	X
Surface Storage – Regional/Local	X	X				X			X	X
Improve Water Quality										
Drinking Water Treatment and Distribution	X		X	X					X	X
Groundwater/ Aquifer Remediation	X	X	X	X	X				X	X
Matching Water Quality to Use	X	X	X		X	X		X	X	X
Pollution Prevention	X	X	X	X	X			X	X	X
Salt and Salinity Management	X	X	X	X	X				X	X
Urban Runoff Management	X	X	X	X	X	X	X		X	X
Improve Flood Management										
Flood Management	X	X		X	X	X			X	X

Resource Management Strategy	Water Supply		Water Quality		Flood Management	Habitat and Open Space		Land Use		Climate Change
	Increase regional water supply reliability to meet demands	Ensure sustainable use of the Fremont Valley Groundwater Basin	Provide drinking water that meets regulatory requirements and customer needs	Protect water quality in groundwater basins in Region	Reduce negative impacts of stormwater	Support water needs of open space/ recreational/ migratory habitat areas	Support protected habitats	Maintain agricultural land uses	Improve integrated land use planning to support water management	Mitigate against climate change
Practice Resources Stewardship										
Agricultural Lands Stewardship	X	X		X	X		X	X	X	X
Ecosystem Restoration	X			X	X	X	X		X	X
Land Use Planning and Management	X	X	X	X	X	X	X	X	X	X
Recharge Area Protection	X	X	X	X	X	X	X	X	X	X
Sediment Management	X			X	X	X	X	X	X	X
Watershed Management	X	X		X	X	X	X	X	X	X
People and Water										
Economic Incentives Policy	X	X	X	X	X	X	X	X	X	X
Outreach and Education	X	X	X	X	X	X	X	X	X	X
Water and Culture	X	X	X	X	X	X	X	X	X	X
Water-Dependent Recreation	X					X	X		X	X

5.3 Overview of Resource Management Strategies

The RMSs identified as applicable to the Region are described in the sections below grouped by the CWP 2013 Update categories. These strategies are either currently being implemented in the Region or are considered strategies that could be used to help meet the Regional objectives and targets.

While addressing climate change is not a separate resource management strategy, climate change adaptation and mitigation activities are embedded in each RMS. Strategies can help the Region adapt to climate change by improving the resilience of water resources in the face of a changing climate and can help mitigate climate change by reducing the energy consumed or GHGs emitted to produce water supply. The following sections describe each RMS relevant to the Region, including how the RMS address the Region's climate change vulnerabilities.

5.3.1 Reduce Water Demand

Reducing water demand is a significant strategy to address supply reliability and adapt to and mitigate climate change impacts. By reducing water demand in the Region through the agricultural and urban water use efficiency strategies, GHG emissions associated with the energy needed to produce, treat and convey water also decrease. Implementing water use efficiency measures also helps the Region adapt to climate change by making conservation a way of life. These strategies can help address potential climate change impacts to water demand and water supply.

Agricultural Water Use Efficiency

Agricultural water use efficiency aims to increase crop productivity and manage costs. This strategy does not necessarily mean a reduction in the amount of water used to grow crops, but rather an increase in crop yield without increasing the amount of irrigation water that must be applied. Common agricultural water use efficiency practices include drip irrigation, covering crops to reduce evapotranspiration, selecting crops best suited to the local climate, and other methods that reduce water use while improving crop yield. This strategy also includes activities such as automating canal control structures, facilitating the financing of capital improvements for on-farm irrigation systems, and promoting customer pump testing and evaluation.

While there is currently only a small amount of agriculture in the Region, agricultural demands for groundwater have impacted the FVGB in the past. Agricultural water use efficiency measures are beginning to become more common in the Region to help support crop yields in the high desert environment.

Urban Water Use Efficiency

Activities under the urban water use efficiency RMS reduce urban water demands using best management practices (BMPs) or demand management measures. Examples include implementing low flow devices, high efficiency washing machines, plumbing retrofits, and rate structures to promote a reduction in urban water use.

In an effort to emphasize and increase water use efficiency, the California State Legislature directed urban retail water suppliers to reduce urban per-capita water use by 20 percent compared to their baseline water use by the year 2020. The City of California City and California Water Service reported progress on meeting their 20 percent reduction in demand in their respective 2015 UWMPs. Both agencies surpassed their 2020 targets by the year 2015 and expect to continue to meet or surpass their water use targets beyond the 2020 deadline.

Water agencies and companies in the Region continue to try to reduce water loss and implement demand management measures to ensure water reliability for their customers during dry periods. For example, the City of California City implements a number of demand management measures as part of their water conservation program, including conducting water survey programs, public landscape retrofitting, and requiring new construction to install low-flow devices. All agencies in the Region intend to improve water use efficiency by reducing water loss through system leaks.

5.3.2 Improve Operational Efficiency and Transfers

Improving operational efficiency and initiating transfers are approaches used by many water agencies to increase supply reliability and reduce water waste. These strategies can help address regional climate change vulnerabilities issues related to supply, water quality, and flooding. For example, improving conveyance systems reduces water loss and the GHG emissions associated with diverting, pumping, treating, and distributing water that is ultimately lost. Similarly, system reoperation encourages efficiencies that can lead to GHG emission reductions. Transfers can also help mitigate climate change if the transferred water eliminates the need to use a more energy-intensive source of water.

These RMSs can help adapt to climate change as well by providing larger conveyance capacity and storage to withstand changing conditions. Aspects of system reoperation can also help adapt to the impacts of a reduced snowpack and increased flooding by maximizing system efficiencies and resilience. Transfers can also help communities adapt to climate change by providing operational flexibility and greater water supply reliability. These RMSs are described further below.

Conveyance – Delta

The Delta is the confluence of the Sacramento and San Joaquin rivers as water is naturally conveyed westward to the Pacific Ocean. The Delta, a vital part of California's water system, supplies water for more than 25 million Californians and supports farms and ranches throughout the state. Water from the Delta is conveyed to the Region via the SWP through an imported water supplier, AVEK.

As a recipient of water from the Delta, the Region supports projects that improve delivery of this water. The Delta's future will be affected by increasing land subsidence, heightened seismic risk, and possible effects of climate change that include rising temperatures, changes in runoff timing, sea level rise, and changes in storm timing, intensity, and frequency. The Bay Delta Conservation Plan, now known as the California "WaterFix", aims to enhance the Delta's ecosystem processes and function, while also providing water supply reliability to the state (DWR 2017). AVEK supports the California WaterFix activities and continues to monitor new program developments.

Conveyance – Regional/Local

The focus of the regional/local conveyance strategy is to increase local supply mobility within the Region to allow resource sharing. Conveyance improvements can help increase local water supplies by incorporating groundwater recharge components, increasing interconnections between other conveyance systems, and increasing conveyance capacity. Improving regional and local conveyance can help reduce water losses, thus, reducing the amount of energy required to treat and distribute water. Upgrading water distribution systems can also improve water quality which reduces the energy required for additional water treatment.

The Fremont IRWM Region relies on regional and local conveyance infrastructure, including diversion structures, pipelines, canals, and pumps to deliver imported water and groundwater to local users. By exploring ways to improve these distribution systems, water supply reliability can be increased.

System Reoperation

This strategy relates to changing existing operation and management procedures with the goal of increasing desired benefits from the system. Reoperation of existing facilities typically serves three basic purposes: (1) addresses a specific problem and/or need; (2) improves efficiencies; and (3) adapts facilities to anticipated future changes.

System reoperation provides a unique opportunity for the Fremont Basin IRWM Region to reduce inefficiencies in the local water systems and improve supply reliability for users in the Region. Some small water agencies are considering projects to update manual metering and pumping systems to automated systems to improve operational efficiencies.

Water Transfers

Water transfers can be a temporary or long-term change in the point of diversion, place of use, or purpose of use due to a transfer, sale, lease, or exchange of water or water rights. Temporary water transfers have a duration of one year or less, while long-term water transfers have a duration of more than one year. Water transfers can become a form of system reoperation linked to many other RMSs and can provide a flexible approach to distributing available supplies.

While groundwater transfers are not implemented or supported in the Region at this time, imported water transfers are considered a viable strategy to increase supply reliability for AVEK, the wholesaler supplier in the Region. Such an arrangement could benefit both the Fremont Basin IRWM Region and its transfer partners by sharing excess imported water in years when one area is supply limited.

5.3.3 Increase Water Supply

Changes in the hydrologic cycle due to climate change will have significant impacts on water supplies in the Fremont Basin IRWM Region. As a result, RMSs that increase drought-resistant, local water supplies are key for mitigating climate change. Better management of groundwater, for instance, eliminates the need to pump from lower water table elevations, thereby decreasing energy use and reducing GHG emissions. Increased recycled water use also reduces the amount of energy needed to convey imported water supplies. Demineralization of groundwater supplies increase the availability of groundwater and can help reduce GHG emissions when renewable or sustainable energy sources are used for pumping.

Strategies that help increase water supplies serve as valuable climate change adaptation tools as well. For example, conjunctive use can improve groundwater management and increase storage of a drought-resistant water supply. Development of demineralization and recycled water as local supplies serve as climate change adaptation strategies as they are less sensitive to climate change than other sources of water supply. The strategies to increase water supplies are described further below.

Conjunctive Management and Groundwater Storage

Conjunctive management refers to the coordinated and planned use and management of both surface water and groundwater resources to maximize the availability and reliability of water supplies. Within the Region, storing excess surface water in the groundwater basin, when available, can be an effective strategy for improving local supply reliability and ensuring sustainable use of the groundwater basins. This strategy can involve management of both imported water and stormwater to recharge the groundwater basin to prevent groundwater depletion and provide flood management and water quality improvement benefits.

As a precursor to potential future conjunctive management and groundwater storage projects in the Region, the RWMG developed a GWMP and SNMP as part of the IRWM planning process. These documents describe the groundwater conditions, including groundwater levels and water quality, to better prepare the Region for utilizing the FVGB in a sustainable manner. Future projects, including groundwater modeling and developing a GSP, will help the Region manage the basin for conjunctive use and groundwater storage.

Desalination (Brackish)

Desalination can be used to reduce salinity in many sources of water, including surface water, groundwater, and municipal wastewater. Because the Fremont IRWM Region is located inland, sea water desalination was not considered applicable to the Region, but brackish groundwater desalination is viewed as an appropriate strategy. Desalinated water can be used for potable uses, such as municipal drinking water, or non-potable applications, such as agricultural irrigation or industrial processes.

Within the Region, there are opportunities for brackish desalination near Koehn Lake where salts accumulate in the dry lake bed, leading to high TDS levels in the groundwater directly under the lake bed. Future projects could explore this strategy as a mechanism for increasing production in that portion of the groundwater basin.

Municipal Recycled Water

The municipal recycled water RMS addresses the recycling of municipal wastewater treated to a specified quality to enable its reuse for another beneficial purpose. Recycling municipal wastewater increases water supply reliability by providing an alternative supply source while reducing demands on higher-quality water potable water. This strategy involves non-potable reuse in which the treated recycled water is used for any application besides drinking water, such as irrigation. This strategy can also involve indirect potable reuse (IPR) wherein the treated recycled water is discharged to recharge basins to infiltrate into the groundwater aquifer or is sent to surface water reservoirs; it can also involve direct potable reuse (DPR) where advanced treated purified water is connected directly to the drinking water supply.

Currently, the Region implements non-potable reuse in California City where recycled water is used at Central Park Lake and for irrigation at the Tierra Del Sol Golf Course. Stakeholders in the Fremont Basin IRWM Region are committed to increasing regional water supply reliability to meet demands using strategies such as municipal recycled water. Recycled water expansion opportunities exist, primarily in California City where the existing recycled water system can be expanded to irrigate the other golf course in the City. However, additional opportunities for recycled water use may be limited to higher density areas near the wastewater treatment plants.

The Region’s stakeholders are open to future opportunities with IPR and DPR.

Surface Storage – Regional/Local

Regional and local surface storage increases local supply through the construction of above-ground reservoirs to collect water for later use. Water storage is especially helpful for areas where regional water demands do not match the natural water supply availability. While surface storage is not currently implemented in the Region, it could be used as a strategy in the future to increase local supply reserves where appropriate.

5.3.4 Improve Water Quality

MPUD water treatment plant and blending tank at well 9

Water quality improvement strategies apply to all types of water supplies and phases of distribution. These RMSs address improving water quality prior to contamination, treating contaminated supply sources, and ensuring quality water that meets regulations.

Strategies that improve water quality can provide significant climate change mitigation benefits. The Region can help mitigate climate change, for example, by improving energy efficiency related to water treatment and distribution. Pollution prevention activities, such as reduced vehicle use and reduced fertilizer application, also help reduce the release of GHG emissions. Additionally, managing urban runoff and capturing stormwater for beneficial reuse can help decrease the energy required to import water.

These RMSs are also important tools for adapting to climate change. By managing flood flows through urban water management strategies, for example, the Region can adapt to climate change by slowing flows and reducing flood damage. Safeguarding water resources from high concentrations of salinity can also help the Region increase and diversify its supply portfolio. Other pollution prevention activities, such as impervious surface removal and onsite rainwater harvesting, can help increase the amount of water that is naturally treated and used onsite. The Region can also adapt to climate change by regionalizing water supply systems to add operational flexibility during periods of drought. The water quality improvement RMS are described further below.

Drinking Water Treatment and Distribution

This RMS encourages development and maintenance of water treatment and distribution facilities with the goal of delivering a reliable supply of safe drinking water. This entails upgrading deteriorating infrastructure, safeguarding source water quality, implementing innovative technology for water treatment, and attaining adequate financial assistance for infrastructure upgrades. Critical components of drinking water treatment and distribution include protecting public health and safety by meeting state and federal drinking water standards and monitoring existing and emerging contaminants of concern. Developing disaster preparedness plans can also help mitigate water supply disruption due to security breaches, acts of terrorism, and natural disasters.

This RMS is a critical strategy for the Fremont Basin IRWM Region. Changing MCLs for various constituents, including hexavalent chromium, can result in exceedances that will require extensive investment to correct. Blending can be used as a treatment technique in cases where removal treatment methods are cost-prohibitive.

Groundwater Remediation/Aquifer Remediation

Implementing groundwater and aquifer remediation efforts can help remove critical contaminants such as heavy metals, salts, and other constituents such as arsenic that degrade quality. Groundwater remediation can be accomplished by either extracting and treating groundwater outside of the basin or by treating groundwater within the basin through biodegradation and natural attenuation processes. Basin water quality may also be improved by recharging with noncontaminated water.

This RMS can help the Region increase the reliability of local supplies, increase storage for excess surface water and/or recycled water, decrease dependence on imported water, and prevent contamination from spreading. The Fremont Basin IRWM Region developed a GWMP for the FVGB to identify groundwater quality and quantity issues and develop potential implementation measures to combat these issues. The GWMP, as well as potential future groundwater modeling and GSP development, will help the Region identify, remediate, and monitor implementation of this strategy.

Matching Water Quality to Use

The underlying principle of matching water quality to use is to only treat water to the level that is required by the end use. This way of thinking encourages water quality to be consistent with its intended use and considers a substance a "contaminant" only when it has adverse impacts on the proposed water use. For instance, drinking water supplies are required to meet much more stringent treatment levels than non-consumptive water uses such as recreation or irrigation.

The City of California City currently implements this strategy by using treated wastewater for use in the Central Park Lake and for irrigation at the Tierra Del Sol Golf Course. Future projects may investigate using recycled water for additional non-potable uses or groundwater recharge.

Pollution Prevention

Pollution prevention aims to reduce contaminants at the source and promotes preventative activities such as: 1) the implementation of regulations or practices that reduce the generation and discharge of pollutants into the environment; 2) modifications to toxic production processes; 3) substitution of harmful pollutants with less toxic constituents, 4) utilization of technology to prevent pollutants from entering the environment, and 5) education and outreach. By preventing pollution at its source, there is a decreased need for more costly water treatment in the future. Clean surface water bodies also provide increased opportunities for water recreation and suitable habitat for wildlife. Because surface water and runoff recharge groundwater, overall surface water quality improvements also lead to groundwater quality improvements.

The majority of the Fremont Basin IRWM Region uses onsite septic systems. Septic systems can leak and degrade groundwater quality. Future projects in the Region might utilize the pollution prevention RMS by increasing the number of residents connected to a wastewater treatment plant, thereby preventing pollution of groundwater at one key source.

Salt and Salinity Management

Salinity in water is increased when calcium, sodium, sulfate, chloride, nitrate, and other substances enter a water body. These substances can be naturally released from minerals or come from anthropogenic activities like fertilizer application. High concentrations of salinity cause declines in agricultural production, soil degradation, higher utility rates, habitat loss, and corrosion of water and wastewater facilities. Proactive salt and salinity management maintains and recovers usable water supplies through combinations of source control, dilution, and treatment of water. Proper salt and salinity management provides several benefits, including beneficial water use protection, increased water supplies, and economic stability.

As part of the IRWM planning process, the RWMG developed a SNMP for the FVGB. While there is no salinity TMDL for the Region, salt management is critical due to the use of recycled water. The SNMP provides a preventative measure to ensure sustainable use and water quality protection for the FVGB.

Urban Runoff Management

The urban runoff management strategy applies to both stormwater and dry-weather runoff management. Stormwater runoff is water that flows following a rainfall event, while dry-weather runoff is caused by activities such as over-irrigation and other types of discharge not associated with rainfall. Increases in the amount of impervious surface area caused by urbanization have intensified urban runoff and flood damage. Urban runoff can be managed by implementing low impact development (LID) strategies which are designed to reduce the pollutant loadings and lessen the volumes and velocities of urban runoff.

As climate change impacts precipitation patterns, the Fremont Basin IRWM Region may experience increases in the number and severity of flood events. Managing the urban runoff created by these events provides opportunities to reduce pollutant loading in surface water flows, while also promoting retention of stormwater for beneficial reuse.

5.3.5 Improve Flood Management

Flooding during storm events is an issue in many areas of the Region. Climate change is anticipated to cause more frequent and more severe flooding, which may result in a high vulnerability for the Fremont Basin IRWM Region. Improved flood management inherently helps adapt to climate change by strengthening flood management practices and adapting to these changes. If floodplain restoration is incorporated into a flood management strategy, this strategy can also help mitigate climate change by sequestering carbon in newly formed or restored floodplains.

Flooding in California City

Flood Management

Flood management as part of an integrated water management approach seeks a balance between exposure of people and property to flooding, the quality and functioning of ecosystems, the reliability of water supply and water quality, and economic stability that includes both economic and cultural considerations. The flood management strategy contains multiple potential approaches including:

- Nonstructural, such as land use planning and floodplain management
- Structural, including flood infrastructure and reservoir and floodplain storage and operations

- Restoration of natural floodplain functions, like promoting natural hydrologic, geomorphic, and ecological processes and reducing invasive species; and
- Flood emergency management, such as flood preparedness, emergency response, and post-flood recovery

There are many potential opportunities to improve flood management in the Region. Areas of the Region flood regularly during storm events and could benefit from structural and nonstructural approaches to flood management. As climate change increases flooding risk, this RMS will be critical for the Fremont Basin IRWM Region.

5.3.6 Practice Resources Stewardship

Practicing resource stewardship helps maintain and restore important natural ecosystem functions that contribute to sustainable water resources management. These strategies can play an important role in mitigating climate change while simultaneously protecting key resources. For example, agricultural land stewardship can help mitigate climate change by increasing carbon sequestration and limiting management practices that increase GHG emissions. Ecosystem restoration can also be used to expand vegetated areas to sequester carbon. GHG emission reductions can also be achieved by protecting recharge areas that allow use of local groundwater sources rather than other more energy-intensive water supplies. Sediment management strategies can also offset GHG emissions associated with sediment removal practices.

The resource stewardship strategies are also climate change adaptation tools. Land use planning and management promotes sharing information across sectors and allows regional planning for adverse impacts associated with climate change. Better management of agricultural lands, for instance, can lead to flexible cropping patterns, protection and enhancement of wildlife habitats, and prevention of wildfires with effective grazing. Similarly, ecosystem restoration and sediment management can restore natural floodplains and flows to improve flood management and capture more flood waters. The Region can also adapt to droughts, floods, and other impacts of climate change by protecting recharge areas and increasing groundwater supply and quality reliability. Structuring watershed management to provide multiple benefits, such as improved water quality, increased biodiversity, and restored ecological function, helps regions adapt to a changing climate. The resource stewardship strategies applicable to the Region are described further below.

Agricultural Lands Stewardship

The agricultural lands stewardship RMS focuses primarily on private land in agriculture, including cultivated land and rangeland. Land managers practice this RMS by conserving and improving land for food, fiber, biofuel production, watershed functions, and soil, air, energy, plants, animals, and other conservation purposes.

While the Fremont Basin IRWM Region has limited agricultural land in cultivation, stakeholders in the Region support assessing optimal farming crops and identifying ways to protect soil quality.

Ecosystem Restoration

Ecosystem restoration improves the condition of modified natural landscapes and biological communities to provide for their sustainability and for their use and enjoyment by current and future generations. Successful restoration increases the diversity of native species and biological communities and the abundance of habitats and connections between them. This strategy can include reproducing natural flows in streams, controlling non-native invasive plant and animal species, and recovering wetlands so that they can store floodwater, recharge aquifers, filter pollutants, and provide habitat.

Within the Region, this strategy can involve restoring vital habitat for endangered species such as the Desert Tortoise. The Region's water management is also benefited from ecosystem restoration outside the Region. AVEK, the wholesale supplier to the Region, supports the Delta restoration planning work as part of the California WaterFix. The California WaterFix is designed to not only improve the Delta ecosystem but improve water supply reliability for SWP contractors like AVEK.

Land Use Planning and Management

The land use planning and management strategy cuts across many other strategies such as water use efficiency, groundwater quality, flood management and agricultural lands stewardship. For example, directing development away from agricultural lands permits multi-objective management of these lands for agricultural preservation, floodplain management, water quality, habitat conservation, and sustainable development. Stronger collaboration between land use planners and water managers can produce safer and more resilient communities.

Within the Fremont Basin IRWM Region, it is important for land use planning agencies to coordinate with water management agencies to ensure sustainable use of local water sources for future generations.

Recharge Area Protection

Recharge areas are those areas that provide the primary means of replenishing groundwater. Protection of recharge areas requires a number of actions based on two primary goals: (1) ensuring that areas suitable for recharge continue to be capable of adequate recharge rather than being covered by urban infrastructure, such as buildings and roads, and (2) preventing pollutants from entering groundwater to avoid expensive treatment that may be necessary prior to beneficial use. Protection of recharge areas is necessary to maintain the quantity and quality of groundwater in the aquifer.

Stakeholders across the Fremont Basin IRWM Region support protecting and enhancing recharge areas to improve groundwater sustainability.

Sediment Management

Sediment management relates to managing the sand, silt, or clay, suspended in or settled on the bottom of a water body. Pollutants, including those from stormwater, may also be absorbed onto fine-grained sediments and complicate management of contaminated sediment.

Because there is minimal surface water in the Fremont Basin IRWM Region, this RMS is not a major strategy for the Region but can be applicable in some cases. For example, Central Park Lake in the City of California City is used as a recreational area and migratory bird habitat. Sediment management could improve the water quality, habitat and recreational benefits provided by the lake.

Watershed Management

Watershed management is the process of creating and implementing plans, programs, projects, and activities to restore, sustain, and enhance watershed functions. A primary objective of watershed management is to increase and sustain a watershed's ability to provide for the diverse needs of the communities that depend on it, including local, regional, State, federal, and tribal stakeholders.

Specific activities under this strategy include adding wildlife corridors, increasing infiltration, and decreasing irrigated landscaping.

As part of the IRWM Program, the Fremont Basin RWMG is increasing awareness for watershed management in the Region. This RMS will be key as the Region works to integrate adaptive management strategies and collaborate on funding opportunities.

5.3.7 People and Water

Engaging the community in water resources is an important component of the IRWM Program. Several strategies target the connection between people and water to better implement water projects and programs.

Central Park Lake provides multiple benefits to the community and wildlife

Like the other RMSs, these strategies can help mitigate and adapt to climate change. Outreach and engagement can help mitigate climate change when efforts are focused on reducing a community's carbon footprint and encouraging water and energy conservation. The Region can work to identify opportunities for water recycling and renewable energy and to promote water-dependent recreation activities that encourage residents to engage in less energy-intensive activities. Additionally, through outreach and engagement, communities can adapt to climate change by leveraging resources, collaborating on monitoring efforts, and improving information sharing. The Region can also work with community stakeholders to increase open space for recreation and promote resilient ecosystems.

Economic Incentives Policy

Economic incentives include financial assistance, water pricing, and water market policies that are intended to influence water management. These incentives can influence the amount and timing of water use, wastewater volume, and source of water supply. Examples of economic incentives include low interest loans, grants, and water rates and rate structures. Free services and rebates, such as toilet rebate programs, also have a direct effect on the way people use water. Incentives can be created or enhanced by facilitating water market transfers, by creating market opportunities where they did not exist, by expanding opportunities where they currently exist, or by reducing market transaction costs. In each case, new or enhanced market opportunities can influence water management decisions.

Agencies throughout the Fremont Basin IRWM Region, including MPUD, California City, and RCWD, actively pursue and apply for grants to fund water projects. Through participating in the IRWM Program and developing an IRWM Plan, water management agencies will be eligible to obtain funding dollars to support IRWM projects.

Outreach and Engagement

The outreach and education strategy employs the use of tools and practices to facilitate contributions toward good water management outcomes. These contributions may include adopting water-wise practices, providing insight to decision-makers on the best approaches for water management, and ensuring access to water management information and decision-making.

Outreach and education is a strategy often used to support other RMSs and can help address all Regional objectives. For example, water purveyors in the Region have used outreach and education to promote water use reductions during the drought. During the most recent drought around 2015, California City made conservation awareness and compliance pitches to customers and residents via the City website, Facebook, and other social and digital media sources. The City also conducted door to door canvassing, made radio station public service announcements, and provided information booths at special events funded by the City and other water service providers within Kern County.

Water and Culture

Water and culture are connected in myriad ways, with subtle and complex implications for managing water. This RMS works to consider culture and cultural activities in the framework of water management. Cultural activities that relate to water may include subsistence activities, recreation activities, spiritual activities, historic preservation, public art, and other shared passions, beliefs, histories, and experiences that bring people together. Utilizing cultural considerations in the framing, development, and promotion of management decisions is vital to ensuring legal compliance and sustainable practices. The benefits of this strategy include preserving a community's and a culture's understanding of the regional history and applying traditional knowledge and practices to better sustain and integrate water management.

The Fremont Basin IRWM Region is supportive of cultural connections to water and will continue to work to identify sustainable water management practices that do not conflict with cultural water needs.

Water-Dependent Recreation

The water-dependent recreation strategy involves planning for and supporting recreational water uses. By planning for water-dependent recreation activities in water projects, water managers play a critical role in ensuring that all Californians today and into the future are able to enjoy such activities.

While there is limited water-dependent recreation in the Region, California City's Central Park Lake provides some recreational opportunities for the surrounding community. While it has been used for non-contact recreation in the past, the lake has suffered from degraded water quality conditions, resulting in algae growth, low oxygen levels, and other impediments that have reduced its use by the community. Projects to improve the water quality of the lake could provide multiple benefits.

5.4 Addressing Climate Change Vulnerabilities

As discussed in *Section 2.9: Climate Change*, climate change is likely to have negative impacts within the Fremont Basin IRWM Region, including impacts on water demand, supply, flooding, water quality, and ecosystem and habitat. The RMSs discussed in this chapter can help address these regional climate change vulnerabilities, as summarized in **Table 5-3**.

Table 5-3: Addressing Climate Change Vulnerabilities with Resource Management Strategies

Resource Management Strategy	Water Demand				Water Supply		Water Quality	Flooding	Ecosystem and Habitat	
	Increase in crop demand	Decreased ability to use groundwater storage to buffer drought	Limited ability to conserve further	Limited ability to meet future demand	Decrease in groundwater supply	Decrease in imported supply	Increased constituent concentrations	Increase in inland flooding	Increased impacts to sensitive or threatened species	Decrease in available necessary habitat
Reduce Water Demand										
Agricultural Water Use Efficiency	✓	✓	✓	✓	✓					
Urban Water Use Efficiency		✓	✓	✓	✓	✓				
Improve Operational Efficiency and Transfers										
Conveyance – Delta		✓	✓	✓	✓	✓				
Conveyance – Regional/Local	✓	✓	✓	✓	✓	✓				
System Reoperation	✓	✓	✓	✓	✓	✓	✓	✓		
Water Transfers	✓	✓	✓	✓	✓	✓				
Increase Water Supply										
Conjunctive Management and Groundwater Storage	✓	✓	✓	✓	✓	✓	✓	✓		
Desalination (Brackish Water)	✓	✓	✓	✓	✓	✓	✓			
Municipal Recycled Water	✓	✓	✓	✓	✓	✓				
Surface Storage – Regional/Local	✓	✓	✓	✓	✓	✓				

Resource Management Strategy	Water Demand				Water Supply		Water Quality	Flooding	Ecosystem and Habitat	
	Increase in crop demand	Decreased ability to use groundwater storage to buffer drought	Limited ability to conserve further	Limited ability to meet future demand	Decrease in groundwater supply	Decrease in imported supply	Increased constituent concentrations	Increase in inland flooding	Increased impacts to sensitive or threatened species	Decrease in available necessary habitat
Improve Water Quality										
Drinking Water Treatment and Distribution				✓			✓			
Groundwater/Aquifer Remediation	✓	✓		✓	✓	✓	✓	✓		
Matching Water Quality to Use	✓		✓	✓	✓	✓	✓			
Pollution Prevention							✓		✓	
Salt and Salinity Management	✓	✓		✓	✓	✓	✓	✓		
Urban Runoff Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Improve Flood Management										
Flood Management		✓	✓	✓	✓	✓	✓	✓	✓	
Practice Resources Stewardship										
Agricultural Lands Stewardship	✓			✓	✓		✓	✓	✓	
Ecosystem Restoration								✓	✓	✓
Land Use Planning and Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Recharge Areas Protection	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Sediment Management							✓	✓	✓	✓

Resource Management Strategy	Water Demand				Water Supply		Water Quality	Flooding	Ecosystem and Habitat	
	Increase in crop demand	Decreased ability to use groundwater storage to buffer drought	Limited ability to conserve further	Limited ability to meet future demand	Decrease in groundwater supply	Decrease in imported supply	Increased constituent concentrations	Increase in inland flooding	Increased impacts to sensitive or threatened species	Decrease in available necessary habitat
Watershed Management	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
People and Water										
Economic Incentives Policy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Outreach and Engagement	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Water and Culture	✓	✓	✓	✓	✓	✓			✓	✓
Water-Dependent Recreation				✓					✓	✓

6 Projects

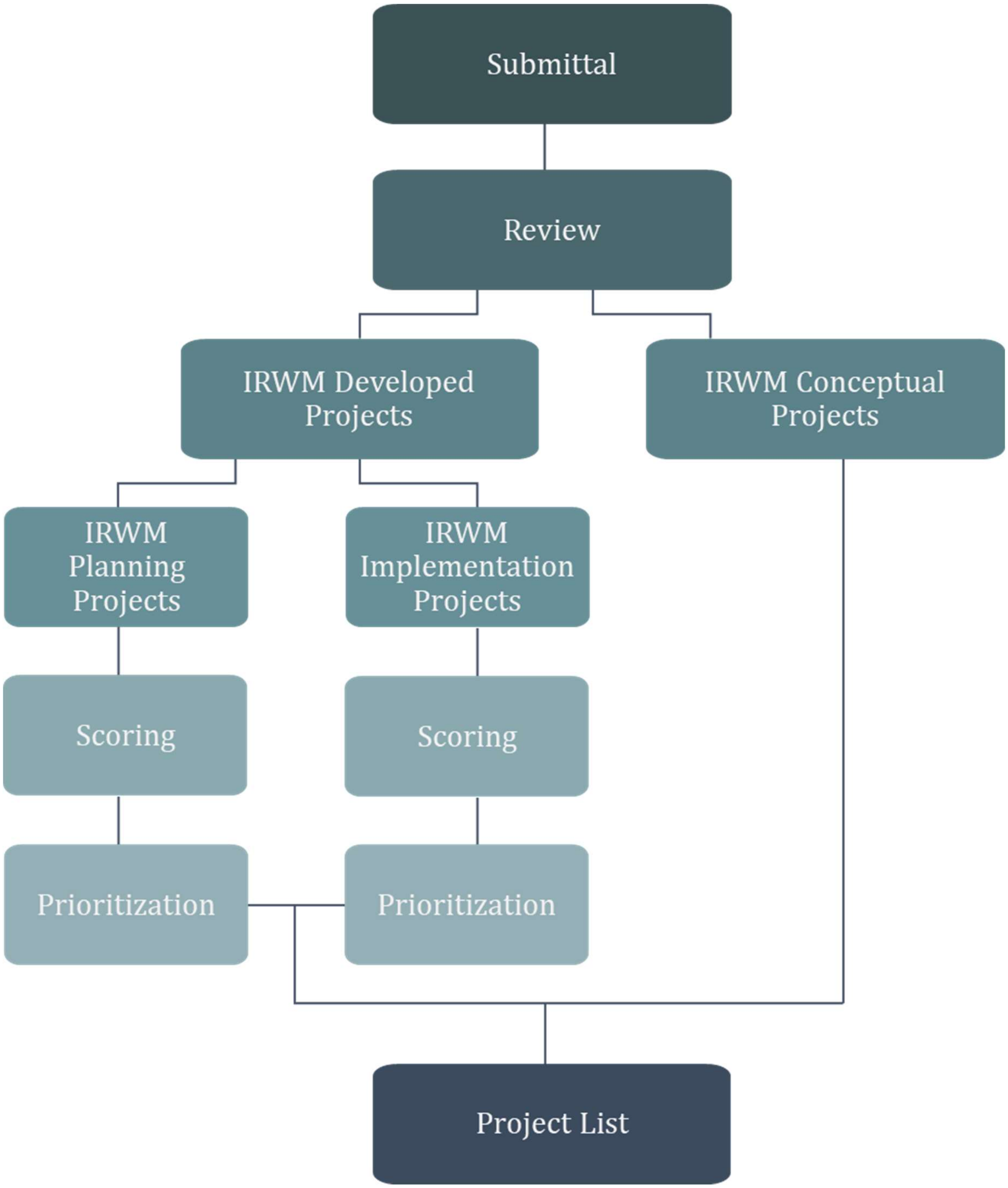
The IRWM Program is designed to support projects that promote regional approaches for the integrated management of water resources. The Program has been successful in encouraging local agencies to collaborate and implement water management solutions that maximize benefits on a regional scale. Projects accepted into an adopted IRWM Plan are eligible for grant funding through the IRWM Grant Program which supports projects that address the needs and goals of a Region. The Fremont Basin IRWM Plan is intended to be a "living document" that will be periodically updated to incorporate new projects and modify existing ones to help the Region move toward meeting its water management objectives, as defined in *Chapter 4: Objectives*. This chapter describes the framework used for project submittal, scoring, prioritization, and acceptance into the Fremont Basin IRWM Plan.

6.1 Overview

The project submittal and review process is a collaborative effort among local water agencies, municipalities, and other stakeholders; it is generally guided by the RWMG. The review process is intended to produce a list of prioritized projects that support pre-established Regional objectives. Then, using the project list, a subset of projects can be selected for specific IRWM Grant Program applications.

Projects submitted to the IRWM Plan are reviewed using the information provided on the Project Submittal Form, an example of which is included in Appendix G, to ensure they are appropriate for the Plan. Projects that meet at least one objective are eligible for inclusion. Once approved, projects are then classified as either "conceptual" or "developed" based on the project's status, level of development, and readiness to proceed. Conceptual projects are those with minimal planning completed and that require further development to quantify project benefits. Conceptual projects are generally expected to evolve into developed projects as planning and design progress. Because conceptual projects are not typically eligible for funding, only developed projects go through the prioritization process based on their ability to produce the greatest Regional benefits. Developed projects are further sorted into "IRWM Planning Projects" and "IRWM Implementation Projects". Both conceptual and developed projects are integrated into the IRWM Plan when approved by the RWMG and the stakeholder group. An overview of the project review process is provided in **Figure 6-1**.

Figure 6-1: Project Review Methodology



6.2 Project Submittal Process

6.2.1 Call for Projects

An initial Call for Projects was held during the August 15, 2017, Stakeholder Meeting to begin the project submittal process for the Region. Stakeholders were invited to fill out a Preliminary Project Information Request Form with basic information such as project name, lead agency, project location, description, and benefits. The purpose of this preliminary project request was to help stakeholders brainstorm and track project ideas while other components of the IRWM Plan were still being developed and discussed. Following the development of the Regional objectives described in *Chapter 4: Objectives* and discussion of the RMS's during stakeholder meetings, a more detailed Project Submittal Form was developed and distributed during the January 18, 2018, Stakeholder Meeting to gather additional information for the project review process.

As part of the Call for Projects, it was explained that projects that align with the water management needs of the Region and provide multiple benefits are highly valued in IRWM Planning. The types of project benefits that are most important for the Region's water management needs include:

- Increase regional water supply reliability to meet demands
- Ensure sustainable use of the Fremont Valley Groundwater Basin
- Provide drinking water that meets regulatory requirements and customer needs
- Protect water quality in groundwater basins in the Region
- Reduce negative impacts of stormwater
- Support water needs of open space/recreational/migratory habitat areas
- Support protected habitats
- Maintain agricultural land uses
- Improve integrated land use planning to support water management
- Mitigate against climate change

6.2.2 Project Submittal Form

To submit a project to the IRWM Plan, stakeholders must complete the IRWM Plan Project Submittal Form, an example of which is included in Appendix G. Hard copies of the form were initially distributed during the January 18, 2018, Stakeholder Meeting and were made available at all subsequent Stakeholder Meetings; hard copies are also available at the California City, City Hall front desk. Electronic versions are available on the Fremont Basin IRWM Facebook page and the City's IRWM web page. The Project Submittal Form requests the following information:

- **General Information**: The lead agency must provide the project name and the primary contact information for the agency endorsing the project. It must also identify any secondary contacts and project partners, if applicable.
- **Project Description**: The project sponsor must identify whether the project is either a conceptual or developed project and if it is classified as either an IRWM Planning Project or an IRWM Implementation Project. It must also specify the location for the project by using a

geographic coordinate system, if possible. The sponsor must provide a comprehensive project description that details how the project will address a pertinent water-related issue in the Region. Relevant supporting information should be provided.

- **Project Benefits**: Each submitted project must respond to the following information regarding project benefits:
  - *How the project contributes to the IRWM Plan Objective*s. To be adopted into the IRWM Plan, the project must help the Region meet at least one of the IRWM objectives outlined in Chapter 4 of this Plan. The submittal form asks that project sponsors identify which IRWM objectives the project will support and quantify those benefits, if possible.
  - *How the project relates to resource management strategies*. The project sponsor must identify at least one RMS that is a feature of the project.
  - *If and how the project provides specific benefits to critical DAC and Native American Tribal community water issues*. Project sponsors should indicate if and how the project will provide any specific benefits to critical water issues in DAC and Native American Tribal Communities.
  - *How the project addresses environmental justice considerations*. The Project Submittal Form asks the sponsor to also identify the project's benefits to stakeholders and to discuss the project's ability to address any environmental justice concerns. Environmental Justice is the meaningful involvement of all people regardless of race, color, sex national origin, or income with respect to the development and implementation of the projects. For water management projects, this can include:
    - Supporting community health, and a clean safe environment
    - Encouraging a more equitable distribution of economic benefits
    - Increasing awareness, understanding, and effective cooperation within and among communities
    - Diversifying the decision-making process by calling for involvement of all people and communities
    - Empowering communities themselves to take action towards improving conditions
  - *How the project contributes to adapting to the effects of climate change and/or reducing GHG emissions*. Projects sponsors must identify any additional sustainability features of the project, including how the project contributes to adapting to climate change effects. Furthermore, sponsors must indicate how the project contributes to climate change mitigation. Considerations for mitigation include using energy efficient appliances and reducing GHG emissions as compared to project alternatives. Use of solar power for a project is one example.
  - *If and how the project reduces reliance on imported water and water from the Delta*. Increasing local supply reliability is a critical objective for the Fremont Basin IRWM

and projects that can help reduce reliance on imported water can help contribute to meeting that objective.

- **Project Status and Schedule**: Project sponsors must provide the project's current status, also referred to as the project's readiness to proceed. Examples of project stages include initial study, planning design, environmental review, and in-construction phases. The sponsor must also propose a timeline for completion.
- **Project Costs and Funding**: The project sponsors should provide the total estimated project costs and list any potential sources of funding. If available, the project sponsors should also provide a basis for the project cost.
- **Project Technical and Economic Feasibility**: If available, the sponsor should provide a cost-effectiveness or cost-benefit analyses to justify the economic feasibility of the project. The economic analysis should include the types of benefits and the types of costs for the project, including capital costs, operation and maintenance (O&M) costs, and any potential adverse effects to others. The sponsor must also include any supporting documents that demonstrate the technical feasibility of the project, including any information that will help determine if the benefits of the project may realistically be achieved.
- **Strategic Considerations**: To maximize benefits on a regional scale, the project sponsor should determine the ability for the project to be integrated with other regional projects. The project sponsor must also specify whether the IRWM Plan has been adopted or will be adopted in the future.

Stakeholders were encouraged to submit Project Submittal Forms for the 2019 Fremont Basin IRWM Plan in one of three ways: 1) submit a printed project form to the RWMG lead agency (the City of California City) or to the consultant team helping prepare the IRWM Plan; 2) submit an electronic copy of the form via email to the City or the consultant team, or 3) request the consultant team to fill out the project submittal form on the sponsor's behalf following an in-person or phone interview. In the future, stakeholders will be encouraged to submit projects directly to the City to be reviewed and incorporated into the project list, as appropriate.

For the 2019 Fremont Basin IRWM Plan, projects proposals were accepted on an ongoing basis. The consultant team scheduled calls with project sponsors to further develop project concepts and proposals as needed. All submitted projects were compiled for further review, as outlined in the section below.

For ongoing project submittals to the IRWM Plan, project sponsors can receive a copy of the Project Submittal Form by doing one of the following:

- Download the Project Submittal Form from the Fremont Basin IRWM webpage on the City's website
- Email the City Public Works Department to request a copy.
- Obtain a hard copy of the form at the California City, City Hall Chambers, 21000 Hacienda Blvd, California City.

Project sponsors can submit completed forms via email or at the City Hall Chambers.

6.3 Project Review Process

All completed IRWM Plan Project Submittal Forms are reviewed by the Project Review Committee (Committee) using various review criteria. This section discusses the project review and selection process.

6.3.1 Project Review Committee

The Project Review Committee (Committee), comprised of all three RWMG member agencies, compiles and reviews the completed Project Submittal Forms to determine eligibility for inclusion in the IRWM Plan's project list, or IRWM grant funding as it becomes available. In collaboration with the stakeholder group, the Committee selects project proposals that align with the goals of the IRWM Plan. The Committee also works with project sponsors to provide feedback and guidance for projects that do not align with the IRWM Program or that require additional development to be eligible for inclusion.

6.3.2 Project Review Factors

During the project review process, the Project Review Committee looks for projects that provide integrated, multi-benefit solutions and that address the Region's water management needs; at least one IRWM Plan objective must be met. The Committee first reviews the Project Submittal Forms for accuracy and completeness. Project proposals are then categorized as either conceptual projects or developed projects based on the project's readiness to proceed. While not all projects may be in a stage where they are eligible for IRWM Planning or Implementation funding, projects in all stages are eligible to be included in the project list if they meet the basic criteria. Keeping a complete inventory of conceptual projects allows the Region to monitor progress toward meeting IRWM objectives and to identify potential opportunities for modifying or integrating project concept ideas with more fully-developed projects. Conceptual projects are compiled into a project list that is periodically reviewed. During these periodic reviews, projects that have become more developed are re-categorized as "developed" and are moved forward for prioritization. All developed projects are further reviewed to prepare for the next step in the project review process, project prioritization, which is further discussed in *Section 6.3.4: Project Prioritization*.

The initial project review is important for guaranteeing that projects align with the goals of the IRWM Plan. As such, the Project Review Committee confirms that each project supports at least one of the ten IRWM Plan objectives outlined in *Chapter 4: Objectives*, and if possible, that those benefits are quantified. The Committee also ensures that all projects utilize a minimum of one RMS delineated in *Chapter 5: Resource Management Strategies*. **Table 6-1** outlines the preliminary factors used by the Project Review Committee to determine which projects are included in the IRWM Plan, and whether they should be categorized as conceptual or developed. All of the requested information below is summarized in *Section 6.2.2: Project Submittal Form* and is contained in the IRWM Plan Project Submittal Form included as Appendix G. All information reviewed as part of the project review process is included in the Project Submittal Form.

Table 6-1: Factors for Project Review

Review Factor	Conceptual Project	Developed Project
General Information	✓	✓
Project Description	✓	✓
Project Benefits	✓	✓
Project Status and Schedule		✓
Project Costs and Funding		✓
Project Technical and Economic Feasibility		✓
Strategic Considerations		✓

After the Committee reviews each project and selects which projects are included the IRWM Plan, the list of projects is presented to the stakeholder group for approval. Projects not selected for inclusion in the Plan are provided feedback on how those projects could be further developed to meet the minimum requirements for inclusion in the IRWM Plan.

As applicable, the Project Review Committee will be responsible for identifying and communicating potential project integration opportunities.

The Project Review Committee will review projects on an ongoing basis at an appropriate frequency, dependent on the number of Project Submittal Forms received and any time sensitivities expressed by the project sponsors. The RWMG will determine how often the Project Review Committee will need to meet to discuss project submittals.

6.3.3 IRWM Project List

Table 6-2 lists the projects that were submitted to and selected by the Project Review Committee for inclusion in the 2019 Fremont Basin IRWM Plan. These recommendations were presented to and approved by the stakeholder group during Stakeholder Meetings held during the 2019 Plan development. Details about the projects can be found in Appendix H. A copy of the IRWM project list is posted on the Fremont Basin IRWM websites, and updated as needed, to provide stakeholders access to the current project list.

Table 6-2: Projects in the Fremont Basin IRWM Region

Project Sponsor	Project Name
AVEK	Blending Intertie at Rosamond Water Treatment Plant
AVEK	North Feeder Chlorination Station
AVEK	North Feeder Pump Station
California City	Convert WWTP from Chlorine to UV
California City	Central Park Lake Restoration
California City	Chromium-6 Blending
California City	Fremont Valley Groundwater Basin Groundwater Sustainability Plan
California City	North Side and South Side Water Main Replacement
California City	Septic to Sewer Conversions
California City	Sewer Plant Headworks
California City	South Side Water Main Replacement Project
California City	Stormwater Capture and Recharge
California City	Well 4 Improvement
California City	Wonder Acres Tank and Booster Pump
Mojave Chamber of Commerce	Mojave H and I Streets Flood Control Project
MPUD	Wastewater Treatment Plant Headworks
MPUD	Well 30 Blending & Distribution System Enhancements
Rancho Seco	Booster Pump Building & Earth Work
Rancho Seco	Northern Fremont Valley Soil Stabilization and Revegetation
RCWD	Distribution System Isolation Valve
RCWD	Lockable Sampling Tabs
RCWD	New Water Meters for 300 Connections
RCWD	Shut-off Valves for Fire Hydrants

6.3.4 Project Prioritization

As previously mentioned, only developed projects selected by the Project Review Committee and stakeholder group advance to the project prioritization process. In this phase, developed projects are first labeled as either IRWM Planning Projects or IRWM Implementation Projects. IRWM Planning Projects support the development or the update of a plan or study, whereas IRWM Implementation Projects directly implement a program or a project (i.e., typically by constructing new facilities). To confirm that projects adopted into the IRWM Plan help the Region achieve its IRWM Plan objectives and promote the RMSs, the Project Review Committee has developed project prioritization criteria and a scoring rubric. The prioritization process highlights projects that will deliver the most widespread benefits relative to the Region's specific needs and objectives. This prioritization process rewards projects that are sufficiently developed, demonstrate a need, are consistent with the goals of the IRWM Plan and provide multiple benefits to the Region. The prioritization methodology is designed so that the projects that provide the most benefit for the Region receive a higher score. Ranked projects are then grouped into low, medium, and high priority projects to eliminate minor discrepancies with the prioritization criteria and scoring rubric.

Prioritization Criteria

To help in the prioritization process, the RWMG developed several prioritization criteria, including funding, innovative technology, and Regional benefits. Each criterion was assigned a point value to create a scoring rubric, as shown in **Table 6-3**. The Project Review Committee uses this scoring rubric to evaluate developed projects and assign points for each criterion met. The prioritization criteria and scoring rubric was presented to and unanimously approved by the stakeholder group during Stakeholder Meeting #11, held on February 15, 2018. It is important to note that this rubric may be updated as the IRWM Plan's objectives and RMS evolve in the future. Projects with the highest overall score are intended to reflect the Region's priority projects.

Table 6-3: Project Prioritization Criteria and Scoring Rubric

Criteria	Consideration	Possible Points
Quantifies benefits	How many quantified benefits does the project provide? Are the benefits justified?	Each quantified benefit = 1 point Justification per benefit = 1 point
Addresses IRWM Plan Objectives	How many objectives does the project address?	Each IRWM Objective = 1 point
Utilizes RMS	How many RMS are utilized by the project?	1-2 RMS = 1 point 3+ RMS = 2 points
DAC Benefits	Does the project provide specific benefits to critical DAC water issues?	Yes = 1 point
Tribal Community Benefits	Does the project address water issues in Tribal Communities?	Yes = 1 point
Environmental Justice Considerations	Does the project encompass environmental justice considerations?	Yes = 1 point
Addresses Climate Change	Does the project adapt to climate change and/or reduce GHG emissions?	Yes = 1 point
Technical Feasibility	Is there any supporting documentation for the project (i.e., planning or design documents?)	Yes = 1 point
Economic Feasibility	Is there a complete cost/benefit analysis?	Yes = 1 point

A detailed table showing the individual scores for the developed projects is presented in Appendix I and available on the Fremont Basin IRWM Plan website at http://www.californiacity-ca.gov/CC/index.php/fremont-basin-irwm. The prioritized project recommendations were presented to the stakeholder group during the March 15, 2018, Stakeholder Meeting. The stakeholder group discussed the projects and scoring and agreed that some project scores could be improved with additional information. The prioritized list of projects is a “snap shot” of the projects at their state of development at the time when this IRWM Plan was developed. The actual project list is a living document that will continue to be updated as new projects are reviewed and added to the list and as existing IRWM projects progress.

6.4 Project Integration

Integration is an important concept for the IRWM Program. Creating a system where integration can occur is one of the roles of the RWMG. Project integration involves combining existing projects to provide efficiencies through economies of scale where similar local interests can be met with a regional project. Project integration also encourages distinct projects that are geographically separated to collaborate and to meet a common set of objectives in the Region. The goal of project integration is to help projects meet a broader spectrum of benefits on a regional scale. Prior to funding solicitations, the RWMG plans to review the IRWM Plan projects and identify potential integration opportunities not previously identified among the submitted projects. During the review process, and as new projects are added to the project list, the Project Review Committee will assess project objectives and consider how new, expanded, or even different solutions can help meet multiple local needs. These integration opportunities for project efficiencies will then be communicated to the project sponsors and discussed at Stakeholder Meetings.

6.5 Project Review for the IRWM Grant Program

The project review and selection process for the IRWM Grant Program is a separate process from the review and selection for inclusion in the IRWM Plan. Standards and requirements for the IRWM Grant Program will be reviewed by the RWMG when guidelines for the various IRWM grant funding programs become available. If the Fremont Basin IRWM Region chooses to submit an application for a particular round of IRWM implementation grant funding, the RWMG will develop a specific process and criteria for submittal, review, and selection of projects to include in the Region’s IRWM implementation grant application. The projects selected for the application will need to be included in the IRWM Plan prior to being included in the grant application. When new rounds of grant funding are made available, the RWMG may conduct additional project solicitation efforts to bring new projects into the IRWMP. The process for project review and selection for the IRWM Grant Program is summarized in **Figure 6-2**

Figure 6-2: Process for Project Selection for the IRWM Grant Program

7 Implementation

7.1 Overview

This chapter provides a framework for the long-term implementation of the Fremont Basin IRWM Plan. It identifies the potential impacts and benefits of Plan implementation, both within the IRWM Region and between neighboring IRWM Regions. It also contains performance measures and monitoring methods to ensure that the IRWM objectives are achieved. The Plan delineates the process for data management, including data collection, storage, and dissemination to stakeholders and state agencies. Finally, it identifies funding sources for Plan implementation, including the projects discussed in *Chapter 5: Projects*. The policies, procedures, and management strategies contained in this chapter allow the Region to quickly adapt to changing conditions, including climate change, technological advances, and information availability.

7.2 Impacts and Benefits

To ensure the long-term success of the IRWM Plan, it is important to clearly communicate the effects of implementing the Plan. Increased transparency helps water resource managers and stakeholders understand and address any potential adverse effects that Plan implementation may have both on a regional and inter-regional scale. Because the Region is predominately comprised of DACs, impacts and benefits within the Region are correlated with potential impacts and benefits to DACs.

The Fremont Basin IRWM objectives may serve as a proxy for the IRWM Plan impacts and benefits as the objectives influence the projects that are selected and implemented through the IRWM effort. As specific projects in the Plan are implemented, the impacts and benefits of each objective will be realized. A more detailed, project-specific impacts and benefits analysis will occur prior to any grant application the project is included in. Review and update of the impacts and benefits of Plan implementation will occur as part of the IRWM Plan management and update activities.

The sections below discuss the impacts and benefits of each IRWM Plan objective.

Water Supply Objectives

To meet increasing water demands associated with population growth and regional economic growth, it is critical to secure reliable regional water supply sources and sustainably manage the FVGB. Reliability of FVGB supplies is particularly important to DACs that rely on pumped groundwater as their only water supply. The water supply IRWM objectives can be achieved through projects that augment regional water supply, such as increasing recycled water use and increasing stormwater capture. These types of measures will help adapt to potential climate change impacts as well as reduce the need to import water from the Delta, effectively decreasing the energy and GHG emissions associated with imported water conveyance. Adverse impacts from implementing these projects, however, include short-term construction disturbances and increased GHG emissions from construction processes. Sustainable management of the FVGB could possibly lead to restrictions on pumping if future demands increase significantly due to residential, commercial, and industrial growth. **Table 7-1** summarizes in greater detail the impacts and benefits expected from implementing projects that help meet the IRWM objectives related to water supply.

Water Quality Objectives

Protecting groundwater quality and providing safe drinking water in the Region can be achieved by implementing a wide range of projects, including but not limited to wastewater treatment plant upgrades, septic tank conversions, and pollution prevention and remediation. Implementing these IRWM objectives will improve regional water quality, which is a priority for the Region, particularly for DACs who rely on the FVGB as their only water supply. Potential adverse impacts within the Region include site-specific construction disturbances, restricted land use activities, increased land use monitoring, and increased energy use associated with water treatment. The benefits and impacts of projects that help implement water quality IRWM objectives are further explained in **Table 7-2**.

Flood Management Objective

The flood management IRWM objective can be achieved by implementing projects that reduce the negative impacts of stormwater, including projects that improve flood management infrastructure and stormwater capture. Flood management has the potential to reduce property damages associated with floods, improve water quality, and support adaptation to potential climate change impacts while augmenting local water supplies and decreasing regional dependence on imported water. Adverse impacts of flood management, however, include localized construction disruptions, land use restrictions, and ecosystem disturbances within the Region. **Table 7-3** summarizes the potential impacts and benefits expected from implementing projects that help meet the flood management IRWM objective.

Habitat and Open Space Objectives

IRWM objectives related to habitat and open space provide widespread benefits inside and outside the Region. Projects that meet these IRWM objectives, such as ecological preservation and restoration projects, protect native and endangered species such as the desert tortoise while balancing the open space needs local communities. Though these IRWM objectives take into account local economies and regional growth, they could potentially support the case for land use restrictions. The impacts and benefits expected from implementing projects that help meet habitat and open space IRWM Objectives are summarized in **Table 7-4**.

Land Use Objectives

IRWM objectives related to land use support the local economies of the Region, including renewable energy and agriculture. Maintaining agricultural land uses and improving integrated land use planning to support water management will support the regional economy and improve water supply, water quality, and flood control within the Region. Though benefits are widespread, implementing the IRWM objectives related to land use could potentially limit future land development in the Region. Effects on areas outside the Region are not expected. The impacts and benefits of implementing projects that help meet land use IRWM objectives are summarized in **Table 7-5**.

Climate Change Objective

Mitigating climate change will lead to widespread inter- and intra-regional benefits. Renewable energy use will support the local renewable energy industry as well as decrease GHG emissions. Reduced GHG emissions will also improve air quality both inside and outside the Region and abate potential climate change impacts in the future. There are no anticipated adverse impacts outside the Region associated with mitigating climate change; however, there may be increased costs associated with implementing mitigation measures for the Region. Impacts and benefits associated with implementing mitigation measures are summarized in **Table 7-6**.

Table 7-1: Impacts and Benefits Related to Water Supply Objectives

<table>
<tr><th rowspan="2">Objective</th><th colspan="2">Within IRWM Region</th><th colspan="2">Inter-Regional</th></tr>
<tr><th>Potential Impacts</th><th>Potential Benefits</th><th>Potential Impacts</th><th>Potential Benefits</th></tr>
<tr><td>Increase regional water supply reliability to meet demands</td><td>• Increased short-term construction and site-specific impacts
• Increased energy use and GHG emissions associated with facilities for recycling water</td><td>• Increased ability to adapt to potential climate change impacts
• Improved water system reliability
• Support projected population growth and the regional economy
• Decreased dependence on imported water from the Bay-Delta
• Decreased energy use and GHG emissions associated with imported water</td><td>• None identified</td><td>• Increased Bay-Delta water supply and associated environmental impacts
• Decreased energy usage and GHG emissions associated with reduced imported water</td></tr>
<tr><td>Ensure sustainable use of the Fremont Valley Groundwater Basin</td><td>• Potential future restricted local groundwater use</td><td>• Increased local water supply reliability and resilience
• Increased groundwater quality
• Increased ability to adapt to potential climate change impacts
• Reduced groundwater overdraft and prevalence of dry wells
• Decreased dependence on imported water from the Bay-Delta
• Decreased energy usage and GHG emissions associated with imported water
• Decreased energy usage associated with local pumping</td><td>• None identified</td><td>• Increased Bay-Delta water supply and associated environmental impacts
• Decreased energy usage and GHG emissions associated with reduced imported water</td></tr>
</table>

Table 7-2: Impacts and Benefits Related to Water Quality Objectives

Objective	Within IRWM Region		Inter-Regional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Provide drinking water that meets regulatory requirements and customer needs	• Increased energy use and GHG emissions associated with treating potable water • Increased water treatment costs	• Improved potable water quality and supply availability • Reduced public health issues associated with drinking water	• None identified	• None identified
Protect water quality in groundwater basins in the Region	• Increased short-term construction and site-specific impacts • Restricted activities that degrade groundwater and increased monitoring of specific land use practices • Increased energy use and GHG emissions associated with treating water for recharge	• Decreased degradation of the Fremont Valley Groundwater Basin and increased water quality and supply • Decreased dependence on imported water from the Bay-Delta • Reduced exceedances that could cause a need for wellhead treatment or to shut down wells • Decreased water treatment costs • Decreased energy consumption and GHG emissions associated with treating pumped groundwater	• None identified	• Increased Bay-Delta water supply and associated environmental impacts

Table 7-3: Impacts and Benefits Related to the Flood Management Objective

Objective	Within IRWM Region		Inter-Regional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Reduce negative impacts of stormwater	• Increased short-term construction and site-specific impacts • Increased land use restrictions • Changes in sediment loads and distribution • Natural habitat and open space deterioration from reduced flows	• Reduced flood risk to property and life • Decreased flood insurance costs • Increased aquifer recharge and increased water supply • Reduced runoff and improved water quality • Increased ability to adapt to potential climate change impacts • Decreased dependence on imported water from the Bay-Delta • Decreased energy usage and GHG emissions associated with imported water	• None identified	• Increased Bay-Delta water supply and associated environmental impacts

Table 7-4: Impacts and Benefits Related to Habitat and Open Space Objectives

Objective	Within IRWM Region		Inter-Regional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Support water needs of open space/ recreational/ migratory habitat areas	• Restricted land use and development • Decreased water supply available for other uses	• Protected native and endangered species • Improved water quality • Balance the needs of environmental resources and communities	• None identified	• Protected native and endangered species
Support protected habitats	• Limited urban land use development • Restricted agricultural practices • Reduced revenue associated with limiting land use	• Protected native and endangered species • Prevented habitat loss and land degradation • Improved recreation, education, water quality, water supply and flood control	• None Identified	• Protected native and endangered species

Table 7-5: Impacts and Benefits Related to Land Use Objectives

Objective	Within IRWM Region		Inter-Regional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Maintain agricultural land uses	• Limited urban land use development • Reduced revenue associated with limiting land use	• Support of the regional economy • Decreased impervious areas and associated flooding issues	• None identified	• None identified
Improve integrated land use planning to support water management	• Reduced revenue associated with limiting land use	• Support of the regional economy • Improved water supply, water quality, flood control, habitat and recreation benefits	• None identified	• None identified

Table 7-6: Impacts and Benefits Related to the Climate Change Objective

Objective	Within IRWM Region		Inter-Regional	
	Potential Impacts	Potential Benefits	Potential Impacts	Potential Benefits
Mitigate against climate change	• Increased costs associated with implementing mitigation actions	• Improved air quality associated with GHG emission reductions • Abatement of potential impacts of climate change • Support of local renewable energy industry	• None identified	• Improved air quality associated with GHG emission reductions • Abate potential impacts of climate change

7.3 Plan Performance and Monitoring

Plan performance and monitoring is critical for measuring IRWM Plan implementation progress and evaluating outcomes relative to the expected benefits. Performance evaluation results are useful for determining whether the Plan effectively meets the needs of the Region and whether strategic changes need to be made. Because the IRWM Plan is a “living document”, the policies and procedures included in the IRWM Plan encourage adaptive management to meet the needs of the evolving Region. These will be adjusted as technology advances, new information becomes available, and climate change impacts manifest. To guarantee long-term success of the IRWM Program, the RWMG is accountable for monitoring Plan performance on an IRWM Plan level, and both the RWMG and project sponsors are responsible for evaluating performance on a project-specific level. This section outlines the procedures for evaluating Plan and project performance, including monitoring and information dissemination.

7.3.1 IRWM Plan Performance and Monitoring

At the IRWM Plan level, performance evaluations ensure that the RWMG is effectively addressing key Regional issues by meeting the IRWM objectives and planning targets. Led by the City of California City, the RWMG will collectively monitor progress towards meeting the IRWM objectives by reviewing the performance measures outlined in **Table 7-7**. Each performance measure identifies at least one data source that can be used to track the planning targets designed to achieve the IRWM objectives.

IRWM Plan performance and monitoring will be conducted by the RWMG prior to each Plan update and documented in the IRWM Plan. The updates will track the progress achieved for each planning target and describe the expected development by the next reporting cycle. Performance findings will be reported on the Fremont Basin IRWM Region website hosted by the City of California City at http://www.californiacity-ca.gov/CC/index.php/fremont-basin-irwm. This website will also serve as the Data Management System (DMS) for the Region. Plan performance evaluation results will be presented during Stakeholder Meetings, which will be held semi-annually or more frequently when a plan update is being conducted. The results will help the RWMG and stakeholders report IRWM Program successes as well as identify potential areas for improvement. This information will be used to guide subsequent IRWM Plan updates, including future project acceptance, prioritization, and implementation processes. Review of the Performance Measures will also signal the need to amend the IRWM objectives and account for new data and regional changes.

Table 7-7: Plan Performance Measures

Planning Targets	Indicators	Data Source	Monitoring Responsibility
Water Supply Objective: Increase regional water supply reliability to meet demands			
Increase recycled water use by 2025 compared to 2017	Recycled water supply data	Recycled water customer meters	City of California City
Increase stormwater capture by 2025 compared to 2017	Stormwater capture data	Project Performance Monitoring Plans	Local water purveyors; project sponsors
Provide adequate supply reserves for single-dry (1,300 AFY) and multi-dry (3,000 AF over 3 years) years	Current and projected water supply and demand data	Groundwater pumping records; imported water records	Local water purveyors
Maintain conservation programs	List of regional conservation programs	Conservation program data; UWMPs	Non-governmental organizations, local water purveyors
Identify infrastructure at risk of being compromised by 2020	List of infrastructure at risk	Capital Improvement Programs	Local water purveyors
Adapt to climate change impacts on runoff and recharge, and from sea level rise	Increase in local supply development projects	Project Performance Monitoring Plans, UWMPs	Local water purveyors; project sponsors; City of California City
Water Supply Objective: Ensure sustainable use of the Fremont Valley Groundwater Basin			
Begin developing a GSA and GSP for the Fremont Valley Groundwater Basin by 2019	GSP development status	Notes from preliminary GSA development meetings	City of California City
Define the safe yield of the Fremont Valley Groundwater Basin by 2027	Safe yield quantification	GSP	GSA
Manage the Fremont Valley Groundwater Basin such that the 10-year average change in groundwater levels is zero.	Groundwater level data	CASGEM and USGS well level data; GSP	GSA
Water Quality Objective: Provide drinking water that meets regulatory requirements and customer needs			
Meet Federal and State water quality standards as well as customer standards for taste and aesthetics throughout the planning period on an ongoing basis	Drinking water quality data	Consumer Confidence Reports	Local water purveyors

Planning Targets	Indicators	Data Source	Monitoring Responsibility
Water Quality Objective: Protect water quality in groundwater basins in Region			
Prevent degradation of groundwater basins according to Basin Plan	Groundwater quality data	SNMP Monitoring Plans; GeoTracker GAMA	RWMG
Map contaminant sites and movement in the Fremont Valley Groundwater Basin by 2027	Map of pollutant locations and transport	GSP	GSA
Flood Management Objective: Reduce negative impacts of stormwater			
Identify areas of highest flood risk in the Region by 2018	Map of flood risk areas	FEMA maps	RWMG
Implement projects to provide flood protection to existing and future planned properties where benefits exceed costs	Projects implemented	IRWMP	RWMG
Implement integrated, multi-benefit flood management projects, when feasible	Projects implemented	IRWMP	RWMG
Habitat and Open Space Objective: Support water needs of open space/recreational/ migratory habitat areas			
Maintain multi-benefit use of Central Park Lake and other water habitat for species	List of Central Park Lake uses	California City General Plan	City of California City
Habitat and Open Space Objective: Support protected habitats			
Support existing protected habitats including the Fremont Valley Ecological Reserve	Number of acres of protected habitats preserved or improved	Land use maps, satellite imagery; City and County General Plans,	RWMG
Land Use Objective: Maintain agricultural land uses			
Support limited agricultural land uses	Number of acres of agricultural lands in active rotation	CropScape, Annual satellite imagery; Kern County General Plan; California City General Plan	City of California City; RMWG
Land Use Objective: Improve integrated land use planning to support water management			
Positive participation of Kern County and municipalities at public meetings; increased correspondence	Public meeting and correspondence contact logs	Public meeting attendance; other correspondences with Kern County	City of California City

Planning Targets	Indicators	Data Source	Monitoring Responsibility
Climate Change Objective: Mitigate against climate change			
Implement mitigation strategies, when possible, that reduce energy consumption, ultimately reducing GHGs	Energy usage data; GHG emission data; mitigation strategies implemented in projects	IRWMP; project work plans	RWMG
Support carbon sequestration and using renewable energy, when possible, to support regional objectives	Sequestration and renewable energy projects	IRWMP; project work plans	RWMG
Consider strategies adopted by CARB in its AB 32 Scoping Plan when developing projects to meet objectives	CARB strategies implemented	IRWMP; project work plans	RWMG

7.3.2 Project-Specific Performance and Monitoring

On a project-specific level, performance reporting ensures that the RWMG implements the projects adopted and prioritized in the IRWM Plan and that each project complies with applicable laws, permits, and rules. The RWMG closely monitors implementation projects though all stages of development. Results from project-specific monitoring efforts will be used to improve the RWMG's ability to implement projects and ensure that the IRWM objectives can be met.

For grant-funded projects, sponsors are responsible for developing project-specific monitoring plans and monitoring activities prior to or in conjunction with project implementation. The project- specific monitoring plans will include monitoring activities to determine if the project is making progress towards meetings its intended benefits and to ensure that each project is monitored to comply with all applicable rules, laws, and permit requirements. Once completed, monitoring plans must be submitted to the RWMG for review. The monitoring data and plans submitted by project sponsors will be made publicly available on the City of California City website. Project sponsors must submit data collected and analysis performed as part of the performance monitoring plans submitted annually to the RWMG and appropriate statewide databases, along with required documentation and an evaluation of project performance. The City will be responsible for maintaining the DMS, and will require agencies submitting data for inclusion in the DMS to describe the quality assurance/quality control measures (QA/QC) used in developing the data, as described in *Section 7.4.4: Data Collection and Dissemination*.

Project sponsors are required to provide the following information in their project-specific monitoring plans:

- Description of what is being monitored for each project, in a table format
- Measures to address problems encountered during monitoring
- Location of monitoring
- Monitoring frequency
- Monitoring protocols and methodologies, including who will perform the monitoring
- Procedures to document monitoring data and a detailed strategy for incorporating the collected data into statewide databases
- Procedures for maintaining a monitoring schedule
- Measures for ensuring that adequate resources are available to maintain monitoring of the project throughout the scheduled monitoring timeframe

7.4 Data Management

The Data Management section is intended to promote the efficient use of available data, describe stakeholder access to data, and confirm that the data generated by IRWM implementation activities can be integrated into existing State databases.

To this end, the Fremont Basin IRWM Region has established data management practices for the IRWM Plan to be followed for projects and programs implemented as part of the IRWM program. Projects and programs implemented outside of the IRWM Program are encouraged to follow similar protocols to maximize usefulness and compatibility of data collected throughout the Region, and to improve potential integration into statewide databases. The following sections identify existing monitoring efforts, regional data needs, and expected reporting procedures.

7.4.1 Existing Monitoring Efforts

There are several existing, ongoing monitoring efforts in the Region being implemented by State, local public, and local private entities to monitor compliance with existing regulations. The various existing monitoring programs are described below.

Groundwater Quality

Public Agencies

Groundwater quality is currently monitored by various public water purveyors in the FVGB (the City, MPUD, RCWD, Rancho Seco Inc., and Cal Water) to meet regulatory requirements, including drinking water regulations enforced by the California Department of Public Health, the SWRCB Division of Drinking Water, and the Kern County Environmental Health Department. The Kern County Water Well and Small Water Systems Program ensures that the public receives water that is safe to drink and the quantity supplied is adequate to meet the community's needs. The Water Well Program issues permits to construct, reconstruct, and destroy water wells. The Small Water System Program is involved with the permitting, inspection, and monitoring of small public water systems and the evaluation of the construction and water quality of existing water wells.

Geotracker-GAMA

The Geotracker- GAMA groundwater information system is California's comprehensive groundwater quality monitoring program that was created by the SWRCB in response to the Groundwater Quality Monitoring Act of 2001. The SWRCB was required to incorporate and display existing water quality data though a publicly accessible interactive online map from various monitoring programs throughout the State. Geotracker-GAMA is based on interagency collaboration with the SWRCB, Regional Water Boards, DWR, Department of Pesticide Regulations, USGS, and Lawrence Livermore National Laboratory. It also relies on cooperation from local water agencies and well owners.

Data reporting frequencies under Geotracker-GAMA range from every three years, to annual, to quarterly, depending on the well and constituent. In the FVGB, groundwater quality is monitored by public agencies at their wells in addition to the data reported on the Geotracker-GAMA online website.

USGS

In addition to the Geotracker-GAMA website, USGS maintains water quality data for groundwater basins in the National Water Quality Information System. USGS reports concentration values every three years. Most readings are taken in August.

Groundwater Levels

CASGEM

The CASGEM program was developed by DWR to track seasonal and long-term trends in groundwater elevations in California's groundwater basins and establish collaboration between local monitoring parties and DWR. The CASGEM program builds upon the many previously established local long-term groundwater monitoring and management programs to track seasonal and long-term groundwater elevation trends statewide.

The CASGEM website provides data for over 250 wells through 2010, but groundwater elevation monitoring occurs on a voluntary basis. Currently, the FVGB is categorized as a low priority basin and the majority of the FVGB is not covered by a GSA. The majority of reported wells have USGS and DWR listed as the monitoring agency. Data are generally reported annually and semi-annually.

USGS

Existing water levels are currently monitored by the USGS for many wells within the FVGB and data are reported on the USGS website https://nwis.waterdata.usgs.gov/ca/nwis/gwlevels. Data are reported annually to semi-annually, depending on the well.

Drinking Water Quality

Safe Drinking Water Act compliance monitoring and reporting

All public water systems are required to comply with the Safe Drinking Water Act. Specific monitoring is required and conducted regularly and reported to the SWRCB Division of Drinking Water. Monitoring information is published annually in Consumer Confidence Reports.

Water Supply and Demands

UWMPs

The Urban Water Management Planning Act requires urban water suppliers to prepare an UWMP every five years that summarizes current and projected water supplies and demands. UWMPs are required of every urban water supplier that either provides over 3,000 AF of water annually or serves more than 3,000 urban connections. California City, AVEK, and Cal Water are the only urban water suppliers serving enough water to need to prepare an UWMP.

Land Use Trends

CropScape

The USDA monitors land cover to provide agricultural acreage estimates to the Agricultural Statistics Board. Crop-specific land cover data is collected on an annual basis using satellite imagery and extensive agricultural ground truth. The geospatial data is publicly available on the CropScape website.

USGS

The Gap Analysis Project (GAP) led by the USGS provides detailed information about the land use patterns and vegetation throughout the United States. Digital maps are derived from satellite imagery, models, existing projects, and public data. The land use datasets are available on the USGS GAP Land Cover online data portal.

Google Earth

Google Earth is an interactive online tool developed by Google that shows three-dimensional landscapes throughout the world. Geospatial data is developed using satellite imagery, aerial photography, and GIS data. Google Earth data are available for years since the mid-1980s and is often used to monitor land use and land cover changes. The land use datasets are available on the Google Earth online portal.

7.4.2 Data Needs

Throughout the Fremont Basin IRWM Region, a variety of local, state, and federal agencies and non-governmental organizations collect data, but those data are not assembled in a uniform or collaborative manner, and in many cases are neither compatible nor comparable. Many of the gaps discussed here are related to a need for regional, integrated planning and associated data support strategies. The local agencies in the Region have limited resources to support detailed and thorough monitoring programs and studies; they are in need of additional funding sources to improve existing monitoring efforts and to support future data collection, analysis, management, and dissemination. The Fremont Basin Region's IRWM planning process can help facilitate better information sharing and identify data needed by the Region's agencies and organizations, project proponents, and stakeholders to more efficiently analyze and understand water resource and environmental conditions within the Region.

Since a primary purpose of IRWM planning is to provide that regional focus, it is expected that this assessment of gaps will be updated and refined substantially over the next several years. Data gaps will continue to be identified through the IRWM program, the groundwater management and salt and nutrient management planning and implementation efforts, and other local and regional planning efforts. In implementing a DMS, the Region will have a single, consolidated location for data which will make identification of data gaps easier and reduce occurrences of unnecessary overlap or duplication of efforts. The DMS will also make it easier to direct users to a comprehensive source of information, increasing the likelihood of knowledge sharing across groups.

The following summarizes the specific data gaps that have been identified throughout the development processes for the 2019 IRWM Plan, the 2018 Fremont Valley Basin GWMP, and the 2018 Fremont Valley Basin SNMP. It is recommended that additional monitoring and studies be conducted to fill in these data gaps.

- Water demands for users served by domestic private wells
- Volume of water loss in municipal systems
- Actual water demands for industrial water users, including the solar, cannabis, and mining industries
- Actual historical and existing agricultural pumping
- Detailed historical and existing agricultural acreage by crop-type
- Consolidated regional data on groundwater levels and quality monitoring
- Consolidated regional data on flooding issues and flood mitigation needs
- Natural groundwater recharge
- Flood volumes and risk

The Fremont Valley Basin SNMP developed and proposed a preliminary monitoring network to monitor and evaluate salt and nutrient constituents in the FVGB. The SNMP monitoring plan proposes to monitor four primary parameters (electrical conductivity, pH, temperature, TDS and nitrate) on an annual basis. Using CASGEM and SGMA monitoring well density guidelines, seven wells from the pool of existing wells were selected for the SNMP monitoring plan. Additional information about the proposed monitoring plan can be found in the Fremont Valley Basin SNMP in Appendix C.

7.4.3 Coordination with Statewide Databases

The State maintains a number of databases for the collection and storage of data, including:

- California Environmental Data Network Exchange
- Water Data Library (WDL)
- GAMA
- CASGEM

To facilitate integration with these statewide databases, the Fremont Basin IRWM Region project proponents will be expected to prepare project-specific monitoring plans that adhere to the data collection techniques and procedures established by relevant statewide databases. This will ensure compatibility of data among projects implemented through the IRWM Program, as well as compatibility with appropriate and relevant statewide databases. As part of submitting data to the Region's DMS, project proponents will be responsible for submitting data to the relevant statewide database(s).

7.4.4 Data Collection and Dissemination

Data will be collected using common, standard techniques appropriate to the type of data collected, collection site conditions, resource availability, and how the data will be analyzed. Data collection techniques are typically described in reports associated with each dataset. All geospatial data collected and maintained by the Region will be accompanied by applicable metadata that describe the data set. Scientifically sound data will be considered for inclusion in the DMS, but methodologies will be the responsibility of the individual organizations. Substantial concerns relating to appropriateness of methodology may be addressed through removal from the DMS, at the discretion of the RWMG. Potential sources of data for the IRWM Program are listed below **Table 7-8**.

Table 7-8: Potential Sources for IRWM Data

Federal	State	Local
National Climate Data Center	California Irrigation Management Information System	Kern County
National Resource Conservation District	Department of Fish & Game	City Planning Departments
Army Corps of Engineers	Department of Public Health	Local Water Purveyors
Bureau of Reclamation	Department of Water Resources	Regional Water Purveyors
Fish & Wildlife Service	State Water Resources Control Board	Kern County Farmer's Bureau
U.S. Geologic Survey	Regional Water Quality Control Board	Stakeholders
National Marine Fisheries Service	California Natural Diversity Database	
U.S. Environmental Protection Agency	California Department of Pesticide Regulation	
U.S. Forest Service		

The City of California City will maintain a centralized DMS on their server, which will house all original data provided by project sponsors. The procedure for submitting data for inclusion in the DMS is as follows:

1. The project sponsor completes monitoring and data collection in accordance with the approved project-specific monitoring plan, including QA/QC procedures.
2. The project sponsor validates data consistent with data validation protocols outlined in the project-specific monitoring plan.
3. The project sponsor "spot-checks" data for accuracy at the time of entry to the database to identify any apparent errors.
4. The project sponsor submits the data to the City of California City for inclusion in the Region's centralized DMS.
5. The project sponsor submits the data to the appropriate statewide database, as applicable.
6. The project sponsor provides the City of California City with confirmation that the data has been submitted to the appropriate statewide database.
7. The City of California City maintains the data in the centralized database.
8. The City of California City disseminates the data to stakeholders and members of the public through the Fremont Basin IRWM webpage on the City's website.

Data collected will be compatible with statewide databases because the project-specific monitoring plans will be developed based on guidance provided for applicable statewide databases. Project sponsors will be responsible for submitting data to the appropriate statewide databases, but the City will coordinate with the agencies to confirm submittal has occurred. The DMS will serve the important function of assisting the RWMG in its goal to share collected data by requiring consistent methodologies for data collection and housing all data in a centralized location that is easily accessed by stakeholders and members of the public. Data collection methodologies will be described as part of the project performance monitoring plans as described in *Section 7.3.2: Project-Specific Performance and Monitoring*. In this way, the DMS supports the objectives by improving data comparability and accessibility.

7.5 Financing

This section of the 2019 IRWM Plan documents a plan for implementation and financing of the IRWM Program and IRWM projects included in this Plan. The RWMG understands the importance of identifying, tracking, and applying for funding as a way to help finance the Fremont Basin IRWM Program and implement critical projects in the Region.

7.5.1 Sources of Funding

There are a variety of funding sources available to help support implementation of the projects and programs in Fremont Basin IRWM Plan. These funding sources include operating funds, ratepayers' assessments/fees/taxes, and local, State, federal grant and loan programs. With a wide range of funding sources available to formulate, maintain, and implement the Fremont Basin IRWM Plan, it is critical for the RWMG to understand current funding opportunities and track other opportunities that may become available in the future. New funding sources, particularly at the state level, are continually added as climate change and drought continue to have impacts on California's water resources. **Table 7-9** below provides a summary of the funding opportunities that are available to the Region at the time of the IRWM Plan development. While some of these opportunities are available on an ongoing basis, many are dependent on forthcoming financial support from measures like the Proposition 1 Water Bond and the Proposition 68 Parks, Environment, and Water Bond.

Table 7-9: Fremont Basin IRWM Funding Opportunities

Funding Mechanism	Funding Administrator	Funding Description
Local / Regional Sources		
Capital Improvement Program Budgets	IRWM Project Sponsor	Funds project costs through Capital Improvement Program (CIP) budgets prepared and adopted by implementing agencies. CIP projects may also be funded, in part, by outside grants or financial assistance.
Private Grants	Foundations or Businesses	Tends to support environmental or restoration projects; Region would only be eligible if the Fremont Basin IRWM Program establishes itself as a 501(c)(3) organization.
Water User Rates	Water Purveyor	Funds projects from construction through operation and maintenance. This source is contingent upon the individual users' willingness to pay.
Taxes or Special Assessments	City or County	Contributes funding to IRWM implementation projects from construction through operation and maintenance. This source is contingent upon residents voting for an increase in taxes or a special assessment to support a project.
State Sources		
CalConserve Water Use Efficiency Revolving Fund	DWR	Provides grant funds for water efficiency upgrades, or low-interest loans to repair or replace water pipes to conserve water.
Clean Water State Revolving Fund (CWSRF)	SWRCB	Provides below-market rate financing to assist communities in preventing pollution of water resources. Eligible projects include but are not limited to the construction of publicly-owned treatment facilities, the implementation of nonpoint source projects to address pollution, and the development and implementation of estuary comprehensive conservation and management plans.
Drinking Water State Revolving Fund (DWSRF)	SWRCB	Provides low-interest loans and technical assistance to eligible entities for water system infrastructure improvements to correct system deficiencies and improve drinking water quality. Projects eligible for funding include treatment systems, distribution systems, interconnections, consolidations, pipeline extensions, water sources, water meters, and water storages.
Groundwater Sustainability Grant Program	SWRCB	Funds projects that prevent and clean up contamination of groundwater that serves as a source of drinking water. Three types of projects eligible for funding include: 1) planning/monitoring, 2) implementation projects, and 3) drinking water treatment.
Infrastructure State Revolving Fund Program	California Infrastructure and Economic Development Bank	Provides financing to public agencies and non-profit corporations, sponsored by public agencies, for a wide variety of infrastructure and economic development projects. Loans are available for the useful life of the project up to a maximum of 30 years.

Funding Mechanism	Funding Administrator	Funding Description
IRWM Grant Program - DAC Involvement Grant	DWR	Funds projects that support disadvantaged community (DAC) planning and project implementation. Applications are submitted by Funding Area (not IRWM Region) and require IRWM Regions to collaborate and disperse funds among the Regions in a Funding Area.
IRWM Grant Program - Planning Grant	DWR	Supports the development of a new IRWM Plan or the update of an existing IRWM Plan.
IRWM Grant Program - Implementation Grant	DWR	Funds implementation of programs and projects that are included in an existing IRWM Plan.
Site Cleanup Subaccount Program	SWRCB	Funds projects that remediate the harm or threat of harm to human health, safety, or the environment caused by existing or threatened surface water or groundwater contamination. Eligible projects may include site characterization, source identification, or cleanup implementation to remediate human-made contaminants.
Stormwater Grant Program	SWRCB	Funds stormwater-related projects, including green infrastructure, rainwater and stormwater capture, and stormwater treatment facilities. Projects must be included in a SWRP and in an adopted IRWMP to be eligible.
Water Recycling Funding Program	SWRCB	Promotes the beneficial use of treated municipal wastewater in order to augment fresh water supplies by providing technical and financial assistance in support of water recycling projects and research. Two types of grants offered include: 1) planning grants, and 2) construction grants.
Federal Sources		
Community Development Block Grants	U.S. Department of Housing and Urban Development	Funds local community development activities that expand economic opportunities, principally for low and moderate-income areas. The program can fund drinking water and wastewater projects.
Rural Development Water and Environmental Program (WEP)	USDA	Offers rural communities (populations < 10,000) funds to develop, construct, or improve water and wastewater infrastructure.
Title XVI Water Recycling and Reclamation Program and WIIN Subset of Title XVI	USBR	Provides grants for construction of water recycling treatment conveyance facilities, including planning, design, and construction costs.
Water & Waste Disposal Loan & Grant Program	USDA Rural Development	Provides funding for clean and reliable drinking water systems, sanitary sewage disposal, sanitary solid waste disposal, and storm water drainage to households and businesses in eligible rural areas.

Funding Mechanism	Funding Administrator	Funding Description
Water Infrastructure Finance and Innovation Act (WIFIA)	US EPA	Establishes a new financing mechanism to accelerate investment of water infrastructure. Eligible projects include but are not limited to projects that are eligible for the DWSRF and CWSRF programs, aquifer recharge, and water recycling projects.
WaterSMART Water & Energy Efficiency Grants	USBR	Provides cost-shared funding for projects that save water; increase energy efficiency and the use of renewable energy in water management; support environmental benefits; mitigate conflict risk in areas at a high risk of future water conflict; and accomplish other benefits that contribute to water supply sustainability in the western United States.

7.5.2 Financing Plan

Given the low-density development and high coverage of DACs and SDACs in the Fremont Basin IRWM Region, project financing has proven to be a major obstacle to project implementation in the past. Demands on limited funds continue to increase, construction costs continue to rise, and existing aging infrastructure requires upgrades to reduce water loss, increase reliability and meet growing demands. In this economic climate, agencies are challenged to balance costs associated with supplying water for new growth while ensuring the highest standards of water quality and supply reliability for existing customers, protecting and enhancing the sensitive ecosystems within the Region, and minimizing costs incurred by end-users. Further, ongoing support and financing of the O&M of projects in this Plan must be considered in addition to one-time planning and construction costs.

The Fremont Basin RWMG understands the importance of considering, at a programmatic level, a financing plan for the IRWM Program to deal with these challenges. Grant and loan programs will likely be an important source of implementation funding for the Region, supported by local sources as noted in **Table 7-9**. Funds for ongoing operation and maintenance costs are expected to derive from many of the same local sources that are identified to fund project implementation, including operating budgets, user rates, and fees and assessments.

The financing plan for any project must be considered prior to implementation. For instance, O&M costs of a proposed implementation project should be evaluated as the overall viability of the project effort is determined. Any project that is advanced for implementation should include an analysis to determine the ability to operate and maintain the project and project benefits over the anticipated life of the project. A determination of the annual fiscal impact on user rates, and the willingness of ratepayers to accept any increased cost of service as may be required for project implementation, should be included in this analysis. The need for water and the economic hardship impacts that would occur, should the new source not be available, may also be considered as part of the analysis. Any benefits derived from replacing and/or updating existing systems can also be considered. The certainty and source of O&M funding for projects will be dependent on the particular project and project proponent. Potential sources of O&M funding for projects include project sponsors' operating budgets and user rates, but the certainty of these funds would be contingent upon funds allocated to operating budget and the customers' willingness to pay.

Table 7-10 on the following page outlines the financing plan for the IRWM Plan, and includes the approximate cost, funding source, and funding certainty for the various IRWM activities.

Table 7-10: Fremont Basin IRWM Plan Financing Plan

Activity	Approximate Total Cost	Funding Source	Funding Certainty/Longevity
IRWM Planning Efforts			
Initial IRWM Plan Development	$880,000	In-Kind: RWMG Agencies Funds: RWMG Agencies, Prop 1 IRWM Planning Grant	Secure through spring 2019
Future IRWM Plan Updates	$120,000	In-Kind: RWMG Agencies Funds: RWMG Agencies, IRWM Planning Grants	Local funds relatively secure but contingent upon agency staff allocations and operating budgets; grant funds less secure and contingent upon future grant programs and success of funding applications
IRWM Program Management			
RWMG Meetings	8 hrs/pp/quarter	In-Kind: RWMG Agencies	Funds relatively secure but contingent upon agency staff allocations
Outreach and Communication	48 hrs/year	In-Kind: RWMG Agencies Funds: RWMG Agencies	Funds relatively secure but contingent upon agency staff allocations and operating budgets of RWMG members
Data Management	120 hrs/year	In-Kind: RWMG Agencies Funds: RWMG Agencies	Funds relatively secure but contingent upon agency staff allocations and operating budgets of RWMG members
Project Review	12 hrs/year	In-Kind: RWMG Agencies Funds: RWMG Agencies	Funds relatively secure but contingent upon agency staff allocations and operating budgets of RWMG members
Funding Procurement			
Funding Applications	Cost varies by type of application and number of projects	In-Kind: RWMG; Project Sponsors Funds: RWMG; Project Sponsors	Many funding programs available, but securing funds is contingent upon on-going agency staff allocations and sponsor's operating budgets
Funding Management	Cost varies by funding type and number of projects	In-Kind: RWMG; Project Sponsors Funds: Project Sponsors	Contingent upon on-going RWMG and agency staff allocations and sponsor's operating budgets
Project Implementation			
Project Implementation	Cost varies by type and scale of project	In-Kind: Project Sponsors Funds: Project Sponsor; Local, State, and/or Federal Funding Programs	Contingent upon on-going agency staff allocations, and sponsor's Capital Improvement Program budgets as well as continued success in obtaining future grant funds

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